JOURNAL OF

ENGINEERING EDUCATION

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APRIL, 1956 Vol. 46, No. 8

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Published monthly (except during July and August) at Prince and Lemon Sts., Lancaster, Pa., by the American Society for Engineering Education under the Supervision of the Publication Committee: W. L. Collins, Chairman, M. M. Boring, N. W. Dougherty, T. Farrell, Jr., G. W. Farnham, M. E. Van Valkenburg, E. A. Walker, E. C. McClintock, Editor. Entered as second class matter, October 17, 1912, at the Post Office at Lancaster, Pa., under the act of August 12, 1912. Accepted for mailing at the special rate of postage provided for in section 132.122, P. L. & R., authorized April 5, 1956. Subscription Price, $6.00 per year; Yearbook Issue, $6.00; Single Copies, $1.25.

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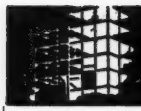

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Editorial Note: A preliminary report on the Humanistic-Social Research Project was given at the last Annual Meeting of the Society in June, 1955. Subsequently a draft of the final report was prepared and circulated late in 1955 to all members of the project committee. Utilizing the comments obtained from this examination, the present "Revised Report" was developed and approved by the full project committtee early in 1956. By this time, pressure was felt to print the extensive report text, and to make it immediately available both for members of the Society and for the many other persons interested in the problems of general studies.

To make possible early publication in the JOURNAL, an unusual step was taken and the revised version was distributed in complete form to members of the ASEE General Council for approval by letter ballot. This has now been obtained, and the Report is therefore presented in this issue of the JOURNAL *for the information of the Society*. Discussion and formal action on acceptance of the report will follow at the Council meeting in June.

The present publication is in the exact form which will be presented at the Council meeting. As for any other report, comments by the Council and any amendments or changes which may be made after discussion will be published in the JOURNAL as soon as they are completed and released by the Committee.

Notes

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DO YOU KNOW . . . .

► . . . . That you should *Aim for Ames In '56?* Dates are June 25–29.

► . . . . That some members of ASEE are not prompt in paying their dues? Three notices have been sent to all members, but an analysis of the total membership of about 8,000 indicates that

90 members have not paid their $6.00 dues
348 members have not paid their $8.00 dues
257 members owe $16.00 in dues
151 members owe over $21.00 in dues
2 institutions have not paid their $25.00 dues
1 institution has not paid its $50.00 dues for two years
6 companies have not paid their $50.00 dues

The total value of all these dues is almost $11,500! This is a tidy sum and it will be greatly appreciated if all who are delinquent pay up promptly. The Society needs this money if it is to carry out its program as planned and budgeted. Those owing $16.00 or more are to be dropped from membership at the end of the current fiscal year, in accordance with the provisions of the Constitution of the Society. It is regrettable that such action must be taken for so large a number. But maintaining non-dues-paying members on the roster is an expensive luxury. If a man no longer wishes to be a member it is much simpler for him to resign than it is to just neglect paying dues until he is dropped. If you haven't sent in your check for the fiscal year 1955–56, please do so immediately.

► . . . . That the Council of the American Association of Physics Teachers has just voted to hold its 1957 Annual Meeting independent of the ASEE Annual Meeting at Cornell? It is regrettable that this cooperative venture failed to materialize.

► . . . . That EJC has decided the Nuclear Congress held early this year was so successful that it will be an annual event? Consideration is now being given to the detailed planning and assignment of responsibilities for the 1957 Congress.

► . . . . That at last year's Annual Meeting the General Council voted that each Section should select a liaison member for the Physics and Relations With Industry Divisions to maintain close relationship and provide direct dissemination of information of mutual interest? Up to the present time this office has received word of such selections from only two sections. More cooperation is needed if this effort is to be worth-while.

► . . . . That more than 1200 ASEE members will converge on Ames for the Annual Meeting?

If you come by car—

Ames is on trans-continental east-west U. S. Highway 30 and on north-south U. S. Highway 69.

If you come by train—

The Chicago and North Western Railroad has four trains daily from Chicago to Ames and three trains daily from Omaha to Ames. You will need to change trains at Chicago or Omaha

if you come from beyond these points. The Rock Island Railroad has three trains daily each way between Kansas City and Milwaukee, but you will have to get off at Des Moines and then take a bus for the 32 miles to Ames.

If you come by bus—

Ten buses leave downtown Des Moines for Ames daily, beginning at 7:00 A.M. The last bus leaves Des Moines at 11:40 P.M. Travel time is approximately one hour.

If you come by plane—

The nearest point for scheduled flights is Des Moines, with an airport 34 miles from Ames. United Airlines has nine flights daily from Chicago, seven from Omaha, and one from Milwaukee. Braniff has three flights daily from Kansas City, three from St. Louis, and six from Minneapolis.

Charter taxicab trips from the Des Moines airport to Ames cost about $12 for one to four persons. Rental cars are available at the airport, but it is best to make arrangements ahead of time for delivery of cars to the airport. Howard Flying Service will meet flights in Des Moines and bring one, two, or three passengers to the Ames Municipal Airport, four miles from the Iowa State College campus, for $13.20 per trip on a charter basis. Arrangements must be made by direct contact with Howard Flying Service, Ames, Iowa. The Ames Municipal Airport is also available to private planes. It has adequate facilities for servicing, and the turf runways are lighted for night landings from dusk to dawn.

► . . . . That the Humanistic-Social Summer School program, June 28–30, is based on the final report of the Humanistic-Social Research Project? At each session the teachers of courses which have proven to be successful will describe the courses they offer, discussing objectives, content, organization, reading assignments, teaching methods, and effectiveness of the courses as given. The particular courses to be discussed at each of the four sessions deal with the history of science, psychology, western civilization, and American civilization. The program will appeal especially to those engaged in teaching similar courses, to engineering educators interested in new methods of teaching the Humanistic-Social stem, and to those who may wish to incorporate such courses in their programs.

► . . . . That the Engineering Drawing Summer School is to be held at Ames on June 20–24? The theme is "Evaluation of Engineering Drawing, Descriptive Geometry, and Graphics for the Future." Particular topics to be discussed include the objectives and motivation of drawing courses, offerings which comply with the Final Report on Evaluation of Engineering Education, creative problems, and simplified drafting. Sessions will correlate and interpret what colleges are doing in terms of what is being done in industry. The program implies that the Drawing Division is taking a long look ahead.

► . . . . That the "Construction Education" summer school sponsored by the Civil Engineering Division is being held June 29 to July 1 at Ames? Conceived as a means of giving empetus and direction to the growing interest in "Construction Education"

throughout the country, the meeting will bring together representatives of education and industry. They will exchange views and experiences and develop programs of cooperation and action. The first session will present the industry point of view. This will be followed by a session discussing typical engineering curricula which prepare the student for construction work. Other topics are teaching methods used in special courses, how industry can cooperate, and, lastly, a general discussion of such topics as the needs of the construction industry for engineers, what special construction education is needed, what new developments influence tomorrow's construction, and how the construction industry can best aid and guide students and faculties.

► . . . . That at the Annual Meeting it is proposed to have available a series of exhibits on teaching aids in nuclear engineering? It is also contemplated that there will be tours through the atomic energy laboratory on the Ames campus.

► . . . . That you should Aim for Ames In '56?

► . . . . That the President of the United States for some time has been concerned as to whether our training of scientists and engineers is keeping pace with the needs of our expanding economy and national security. A special committee reported to the President that, "—we are not now training enough young people in science and engineering to meet our requirements now or in the foreseeable future. There is increasing evidence that unless substantially greater efforts are made to increase our supply of scientists and engineers, particularly those of exceptional and creative abilities, we may well face the loss of superiority in decisive areas of technology in the years immediately ahead."

The committee recognized that the Government has an important responsibility for helping to solve the technological manpower problem, but believes the solution rests primarily with leaders in education, the professions, industry, and labor. As a result, President Dwight D. Eisenhower has appointed a National Committee for the Development of Scientists and Engineers composed of representatives of sixteen organizations having a direct concern with the development of our technology.

As President of ASEE, M. M. Boring has been invited to serve on the committee. Through their meetings they plan to enlist the cooperation and support of the organizations represented for developing a coordinated action program which will help provide the highly trained scientists and engineers we need. T. H. Chilton (member of ASEE) is the EJC representative, Dr. H. L. Bevis (President of the Ohio State University) is Chairman, and E. A. Walker (Dean of Engineering at Pennsylvania State University) is Vice Chairman.

The National Science Foundation will provide staff services for the Committee and provide leadership to other departments and agencies in carrying forward activities which will contribute to a solution of the problem. R. L. Clark, formerly with the Office of Defense Mobilization, comes to NSF to serve as Executive Secretary of the Committee.

W. Leighton Collins
Secretary

NEW MEMBERS OF THE ASEE

ABELE, ERNESTS, Associate Professor in Physics, Ohio Northern University, Ada, Ohio. Alton D. Taylor, Lawrence H. Archer.

ALEXANDER, DANIEL EDWARD, Instructor in General Engineering, University of Washington, Seattle, Washington. D. C. McNeese, A. L. Hoag.

AU, TUNG, Assistant Professor of Engineering Mechanics, University of Detroit, Detroit, Michigan. H. E. Mayrose, C. J. Freund.

BARTLETT, THOMAS E., Assistant Professor in Industrial Engineering, Purdue University, Lafayette, Indiana. H. H. Young, P. W. Case.

BEHN, ROBERT C., Instructor in Engineering Drawing, Case Institute of Technology, Cleveland, Ohio. O. M. Stone, W. A. Deonik.

BOBECK, ROBERT ERWIN, Assistant Instructor, Machine Dept., Wentworth Institute, Boston, Massachusetts. H. Russell Beatty, F. H. Linton.

BONOW, W. BURNETT, Instructor in Civil Engineering, University of Idaho, Moscow, Idaho. L. B. Craine, C. A. Moore.

BROWN, RICHARD WESLEY, Head, Industrial Electricity, Wentworth Institute, Boston, Massachusetts. H. Russell Beatty, F. H. Linton.

BRULLE, ROBERT VANDEN, Assistant Professor in Aeronautical Engineering, Institute of Technology USAF, Dayton, Ohio. P. C. Dow, Jr., V. L. Haneman, Jr.

BURGOYNE, CALEB BERNARD, Assistant Professor in Mechanical Engineering, Mississippi State College, State College, Mississippi. A. G. Holmes, Jr., H. Flinsch.

CAIRNS, JAMES ROBERT, Instructor in Engineering Drawing, University of Detroit, Detroit, Michigan. H. Gudebski, C. G. Duncombe.

CARTLAND, FRED WM., Lecturer, Electrical Engineering, Ohio University, Athens, Ohio. E. J. Taylor, D. B. Green.

CURTIS, ROBERT W., Instructor in Mechanical Engineering, Michigan College of Mining and Technology, Houghton, Michigan. J. A. Anderson, S. Allen.

DALY, EDWARD ARCHIE, Instructor in Mechanical Engineering, South Dakota State College, Brookings, South Dakota.

DELAPP, WARREN WILLIAM, Associate Professor in Civil Engineering, University of Colorado, Boulder, Colorado. L. M. Nordby, R. L. Downing.

DELEO, EMIL ALBERT, Assistant Professor in Industrial Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania. P. F. Fulton, A. G. Holzman.

DIONNE, EDWARD ALDEN, Assistant Professor in Engineering Department, San Jose State College, San Jose, California. J. A. Bailey, R. J. Smith.

DIXON, JOHN DOUGLAS, Assistant Professor in Electrical Engineering, University of North Dakota, Grand Forks, North Dakota. E. L. Lium, R. J. McFarlin.

DOOGE, JAMES, C. I., Instructor in Civil Engineering, State University of Iowa, Iowa City, Iowa. C. J. Posey, J. W. Howe.

ETTINGER, HARRY J., Instructor in Engineering Drawing, New York University, New York, New York. I. Wladaver, L. O. Johnson.

FAZEKAS, GABRIEL ANDREW GEORGE, Associate Professor in Mechanical Engineering, Polytechnic Institute of Brooklyn, Brooklyn, New York. C. L. Oergel, J. R. Curreri.

FEHRMAN, ALVIN LYONE, Instructor in Mechanical Engineering, Institute of Technology, USAF, Wright Patterson AFB, Ohio. H. F. Marco, V. S. Haneman, Jr.

FRANCIPANE, LOUIS JOSEPH, Instructor in physics and English, Newark College of Engineering, Newark, New Jersey. I. P. Orens, A. Capecelatro.

FRANK, ERNEST, Assistant Professor in Electrical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania. H. Sohon, Y. H. Ku.

GALL, WALTER F., Chief of Training Methods & Instructor Training, Francis E. Warren Air Force Base, Cheyenne, Wyoming. H. P. Adams, H. Lineback.

GOETZ, WILLIAM HARNER, Associate Professor in Civil Engineering, Purdue University, Lafayette, Indiana. K. B. Woods, B. H. Petty.

HEACOCK, FRANK AHERN, JR., Instructor, Mathematics & Engineering. Wesley Junior College, Dover, Delaware. A. E. Sorenson, A. L. Bigelow.

HEALY, WILLIAM LEWIS, Specialist Laboratories, General Electric Company, Philadelphia, Penn. C. F. Terwilliger, R. S. Paffenbarger.

HELLMER, CORWIN ARNOLD, Instructor in General Engineering, University of Illinois, Chicago Division, Chicago, Illinois. M. V. J. Dembski, E. J. Caldario.

HODES, ISIDORE, Assistant Professor, Electrical Engineering, University of Notre Dame, Indiana. H. A. Foecke, M. L. Wilcox.

HOLMES, FRED, Instructor in Physics, Wentworth Institute, Boston, Mass. H. R. Beatty, F. H. Linton.

HOUSTON, ROBERT WAYNE, Assistant Professor in Chemical Engineering, University of New Hampshire, Durham, New Hampshire. O. T. Zimmerman, E. T. Donovan.

HUYCK, ASHLYN M., Instructor in Mathematics, Wentworth Institute, Boston, Mass. H. R. Beatty, F. H. Linton.

KENNEDY, WILLIAM JOHN, JR., Instructor, Steam and Diesel Engineering, Wentworth Institute, Boston, Mass. H. R. Beatty, F. H. Linton.

KERR, WILLARD AUGUSTA, Associate Professor in Psychology & Education, Illinois Institute of Technology, Chicago, Illinois. J. T. Rettaliata, E. I. Fiesenheiser.

KILLINGSWORTH, ROY WILLIAM, Assistant to Dean, University of Alabama, Tuscaloosa, Alabama. J. R. Cudworth, J. A. Bennett.

KING, HOWARD WOODSON, JR., Instructor, Civil Engineering, Michigan Tech. Houghton, Michigan. W. C. Polkinghorne, T. O. Reyhner.

KLEMGARD, EDWIN N., Associate Professor, Chemical Engineering, Washington State College, Pullman, Washington. E. G. Ericson, L. B. Almy.

KONICHEK, DORLAND H., Associate Professor in General Engineering, University of Washington, Seattle, Washington. D. C. McNeese, A. L. Hoag.

LARSON, MILTON BYRD, Assistant Professor in Mechanical Engineering, Oregon State College, Corvallis, Oregon. L. Slegel, W. H. Paul.

LEIGHTON, JOHN ROBERT, Instructor, Strength of Materials, Wentworth Institute, Boston, Mass. H. R. Beatty, F. H. Linton.

LEUBA, RICHARD J., Instructor in General Engineering, University of Washington, Seattle, Washington. A. L. Hoag, D. C. McNeese.

LEUTZINGER, RUDOLPH LESLIE, Assistant Professor, Applied Mechanics, University of Kansas, Lawrence, Kansas. K. C. Deemer, A. S. Andes.

LEWIS, BEVAN B., Professor of Railroad Engineering, Purdue University, Lafayette, Indiana. P. E. Soneson, J. M. Hayes.

LIBBY, DOUGLAS FRANKLIN, JR., Instructor in Physics, Wentworth Institute, Boston, Mass. H. R. Beatty, F. H. Linton.

LLOYD-JONES, RICHARD, Instructor in Technical Writing, State University of Iowa, Iowa City, Iowa. J. W. Howe, D. E. Metzler.

LYSE, INGE MARTIN, Professor in Civil Engineering, Norways Institute of Technology, Trondheim, Norway. W. L. Collins, M. M. Boring.

MARSHALL, SCOTT J., Instructor in Electrical Engineering, Colorado School of Mines, Denver, Colorado. R. R. Campbell, A. L. Gosman.

MARTIN, JAMES LAWRENCE, Instructor in Mathematics, Virginia Military Institute, Lexington, Virginia. W. E. Byrne, K. S. Purdie.

MAYO, WILLIAM K., Department Chairman Engineering, City College of San Francisco, San Francisco, California. L. M. K. Boelter, C. M. Duke.

MEALY, DONALD FRANCIS, Instructor in English, Colorado School of Mines. Golden, Colorado. W. J. Chapitis, J. M. George.

MEIER, FRANCE ARNETT, Instructor in Industrial Engineering, Lamar State College of Technology, Beaumont, Texas. G. B. Tims, Jr., R. V. Andrews.

MESSINIDES, HAROLD C., Instructor, Engineering Drawing, Wright Jr. College, Chicago, Ill. B. J. Brille, E. G. Paré.

MILLER, JAMES THEODORE, Instructor, Mechanical Engineering, University of Kentucky, Lexington, Kentucky. M. Baker, E. Elsey.

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MORRIS, EDWARD PORTER, Assistant Professor, Electrical Engineering, Marquette University, Milwaukee, Wisconsin. A. B. Drought, W. G. Murphy.

MCCLAIN, CLIFFORD HENDERSON, Project Engineer, Welding Engineers, Inc., Machinery Division, Havertown, Penn. W. L. Collins, W. M. Lansford.

McNEELEY, FRANCIS J., Engineer (Gen'l) Supervisory, National Security Agency, Rockville, Maryland. F. F. Ashenhurst, W. L. Collins.

NAPP, FREDERICK PETER, Administrative Assistant to Director, Oak Ridge School of Reactor Technology, Oak Ridge, Tennessee. J. C. Von der Lage, W. O. Harms.

NELSON, LEONARD CARL, Director of Engineering, West Virginia, Institute of Technology, Montgomery, West Viriginia. E. F. Obert, R. L. Young.

O'MARA, JOHN JOSEPH, Assistant Professor in Civil Engineering, State University of Iowa, Iowa City, Iowa. J. W. Howe, D. E. Metzler.

PACKARD, WESLEY JAMES, Head Machine Department, Wentworth Institute, Boston, Mass. H. R. Beatty, F. H. Linton.

PARLEE, NORMAN ALLEN, Professor of Metallurgical Engineering, Purdue University, Lafayette, Indiana. W. H. Tucker, T. J. Hughel.

PIAN, THEODORE HSUEH-HUANG, Assistant Professor in Aeronautical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts. R. L. Bisplinghoff, C. S. Draper.

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RITCHIE, EARL A., Personnel Director—Research & Development Division, A. O. Smith Corp., Milwaukee, Wisconsin. D. C. Broughton, W. L. Collins.

ROBICHAUD, REYNOLD FRANCIS, Coordinator, University of Detroit, Detroit, Michigan. H. Gudebski, C. G. Duncombe.

ROCHEFORT, JOHN SPENCER, Associate Professor in Electrical Engineering, Northeastern University, Boston, Massachusetts. M. W. Essigmann, R. I. Carter.

ROCKWELL, THOMAS HUGH, Instructor in Industrial Engineering, The Ohio State University, Columbus, Ohio. P. N. Lehoczky, G. R. Carson.

ROGERS, H. BARRETT, Executive Secretary, National Fluid Power Association, Evanston, Illinois. B. H. Jennings, H. B. Rogers.

ROLAND, HALL CARMACK, Instructor, Math. & Science, Freed-Hardeman College, Henderson, Tennessee. W. L. Collins, C. E. Kesler.

RONEY, MAURICE WILLIAM, Associate Professor, Oklahoma A. & M. College, Stillwater, Oklahoma. C. H. Thompson, H. Lineback.

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SCHROEDEL, KARL BURNETT, Instructor in Industrial Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania. H. W. Wolfarth, A. G. Holzman.

SCHROEDER, DAVID WILLIAM, Assistatnt Professor, Chem. Eng., University of Detroit, Detroit, Michigan. H. Gudebski, L. S. Kowalczyk.

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SHEPARD, HERBERT A., Assistant Professor of Sociology, Economics, and Social Science, Massachusetts Institute of Technology, Cambridge, Massachusetts. W. L. Collins, M. M. Boring.

SIEGEL, MARTIN J., Assistant Professor in Mechanical Engineering, University of Southern California, Los Angeles, California. H. P. Nielsen, T. L. Gershun.

SIMS, BEN WILSON, Training Specialist, Co-Op Coordinator, Lockheed Aircraft Corporation, Georgia Division, Marietta, Georgia. J. G. Wohlford, P. Weber.

SMITH, FRANK R., Assistant Professor in English, Institute of Technology, USAF, Dayton, Ohio. R. H. Downing, L. F. Lewis.

SPENCER, HERBERT HARRY, Instructor of Civil Engineering, Yale University, New Haven, Connecticut. R. P. Vreeland, G. A. Gray.

SPINNA, ROBERT JAMES, Assistant Professor in Civil Engineering, Manhattan College, New York, New York. Brother B. A. Barry, Brother A. Leo.

SWANSON, CARL A., Senior Instructor, Machine Department, Wentworth Institute, Boston, Mass. H. R. Beatty, F. H. Linton.

SWENSON, FLOYD DULANE, Instructor, Civil Engineering, Montana State College, Bozeman, Montana. E. W. Schilling, E. R. Dodge.

THARP, KENNETH J., Instructor in Civil Engineering, Duke University, Durham, North Carolina. A. E. Palmer, P. C. Stottlemyer.

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UIHLEIN, GEORGE VICTOR, JR., National Executive Secretary, Theta Kappa Phi Fraternity, Worcester, Massachusetts. W. R. Grogan, A. W. Back.

ULRICH, BENJAMIN HARRISON, JR., Associate Professor, Aeronautical Engineering, West Virginia University, Morgantown, West Virginia. L. Seltzer, C. H. Cather.

WALWORTH, WALTER F., Instructor in Mathematics, Wentworth Institute, Boston, Mass. H. R. Beatty, F. H. Linton.

WEBB, WAYNE, Professor of Physics, The Pennsylvania State University, University Park, Penn. J. A. Sauer, J. Marin.

WEINAUG, CHARLES FISHER, Professor & Chairman of Petroleum Engineering, University of Kansas, Lawrence, Kansas. J. O. Maloney, K. E. Rose.

WINOGRAD, LEE, Assistant Professor, Aeronautical Engineering, University of Maryland, College Park, Maryland. S. S. Steinberg, R. B. Allen.

YAGLE, RAYMOND ARTHUR, Assistant Professor in Engineering Mechanics, University of Michigan, Ann Arbor, Michigan. R. A. Dodge, J. S. McNown.

ZIMMERMAN, JOSEPH FRANCIS, Assistant Professor in Economics, Government, & Business, Worcester Polytechnic Institute, Worcester, Massachusetts. L. L. Atwood, A. W. Back.

ZUSPAN, G. WILLIAM, Assistant Professor, Metallurgical Engineering, Drexel Institute of Technology, Philadelphia, Penn. A. W. Grosvenor, L. P. Mains.

100 new members
381 previously added

481 new members this year

BLAKE RAGSDALE VAN LEER

President of the Georgia Institute of Technology, Blake Van Leer died January 23, 1956, in Atlanta at the age of 62. The first engineer to hold the position of President at Georgia Tech, Colonel Van Leer was appointed to the office in 1944. Under his guidance, four years later Georgia Tech obtained university status. He made possible in 1948 the establishment, as a unit of Georgia Tech, of the Southern Technical Institute at Chamblee, Georgia. A member of the ASEE since 1923, President Van Leer was a member of the General Council from 1933 to 1936, and was president of the Southeastern Section from 1939–1940.

TEACHING POSITIONS AVAILABLE

MECHANICAL ENGINEER NEEDED AS Associate Professor or Professor and Department Head. Fields of Machine Design, Air Conditioning, Heating, and Ventilation preferred. Department has recently moved into new building and is equipping new laboratories. Housing available at reduced rates. Location, South. APR-2

ASSISTANT PROFESSOR TO TEACH Civil Engineering subjects in large eastern university in metropolitan area. Good salary for right man. APR-3

ENGINEERING DRAWING, DESCRIPtive geometry teachers needed. Salary and academic rank open. Airmail to Professor L. Scott Daniel, Chairman, Department of Engineering, University of Hawaii, Honolulu 14.

ELECTRICAL, MECHANICAL, CHEMical Engineering, and also Mathematics and Physics staff openings. Industrial experience desirable. Opportunity for research. Franklin Technical Institute, 41 Berkeley Street, Boston 16, Massachusetts.

ASSISTANT PROFESSOR—CHEMICAL Engineering for AIChE, ECPD accredited department. PhD required. To begin September 1956. Write to D. L. Green, Clarkson College of Technology, Potsdam, New York.

ASSISTANT PROFESSOR—DRAWING and Descriptive Geometry. Associate Professor to teach Machine Design, Kinematics, Drawing. Master's degree and experience required. For details write to L. M. Sahag, Head, Department of Engineering Drawing and Design, Alabama Polytechnic Institute, Auburn, Alabama.

CIVIL ENGINEERING RESEARCH AND teaching positions. Two vacancies for Assistant or Associate Professors, salaries on twelve-month basis. Part time research and part time graduate and/or undergraduate teaching. PhD preferred, MS acceptable. Candidates must have special training or experience in Highway Engineering or in Structures. Department of Civil Engineering, Alabama Polytechnic Institute, Auburn, Alabama.

EIGHTEEN ENGINEERING TEACHERS are needed in the Departments of Electrical, Mechanical, and General Engineering, The General Engineering Department supervises freshman courses in Drawing, Engineering Problems, and Mechanics. Positions are of Instructor and Assistant Professor ranks. Salaries depend upon academic background and professional experience. Men with advanced degrees are preferred. Teaching and industrial experience are desirable but not essential. Excellent opportunities for advancement. Summer engineering employment is virtually assured. Write to Dean H. E. Wessman, College of Engineering, University of Washington, Seattle 5.

ASSISTANT PROFESSOR AND INSTRUCtor at growing midwest engineering college in Department of Mechanical Engineering, effective fall semester 1956–57. Assistant Professor must have special experience or training in machine design. Teaching assignment for instructor would include: Heat-Power, Manufacturing Processes, and Laboratory. Salary in both grades dependent upon qualifications. APR-1

ASSISTANT PROFESSORS AND INstructors in Electrical and Mechanical Engineering wanted by the College of Engineering, Marquette University, Milwaukee 3, Wisconsin. Salary commensurate with qualifications. M.S. or work toward it desirable. Opportunity for part-time graduate work at state university. Please forward complete details of education, experience, and personal background to respective department chairmen.

HEADSHIP OF INDUSTRIAL ENGIneering department. Requires background of professionally responsible management position in industry or government, plus good record of publications. Research and teaching experience desirable. Age range 35–50; salary open; position to be filled before September, 1956. Write Chairman, Nominating Committee, Industrial Engineering Department, Pennsylvania State University, University Park, Pennsylvania.

ASSISTANT PROFESSORS, INSTRUCTORS, Research Assistants, and Graduate Assistants needed in Engineering Mechanics. Excellent opportunities for graduate work. Write Joseph Marin, College of Engineering, The Pennsylvania State University, University Park, Pennsylvania.

TEACHING POSITIONS IN ENGINEERING technology; teaching and industrial experience desirable. B.S. or M.S. degrees. Cooperative program—Physics, Mathematics, Engineering Drawing, Machine Design, Strength of Materials, Tool Design. Positions beginning September, 1956. Sinclair College, 117 W. Monument Ave., Dayton 2, Ohio.

ASSISTANT DEAN OF ENGINEERING, Master's degree preferred but not required. Salary to depend upon qualifications. Apply to: Dean W. A. Patterson, Fenn College, Cleveland 15, Ohio.

SIX OPENINGS IN ELECTRICAL AND Mechanical Departments. Teaching Assignments: Electric Power, Electronics, Physics, Heat Power, Engineering Drawing, other Mechanical Engineering subjects. Salary depends upon qualifications. Excellent fringe benefits. M.S. in E.E. or M.E. desired. Applicants with B.S. considered. Write to Earle M. Morecook, Chairman, Applied Science Division, Rochester Institute of Technology, Rochester 8, New York.

AGRICULTURAL ENGINEERING POSITION to teach farm structures and machinery and power courses, as well as general engineering courses. Instructor or Assistant Professor rank. Salary commensurate with qualifications. Nine month appointment. Complete new Engineering Center under construction this spring. High and dry climate, no traffic or smog, good schools, lots of elbow room, not an A-bomb target. Write Dean of Engineering, Colorado A & M College, Fort Collins, Colorado.

CHRYSLER INSTITUTE OF ENGINEERING again has openings on its full-time teaching staff. For: supervisor of engineering graduates working on individual automotive design projects as a part of their Graduate School course. Duties would also include supervision of graduate classwork. Desired qualifications are age 25–40; B.S. degree or higher in engineering; at least 2 years of college teaching experience; some design experience, preferably automotive. Also a teacher and supervisor of Graduate School classwork. Qualifications are age 25–40; M.S. degree in engineering; experience in teaching Mechanical Engineering subjects. Write to Chrysler Institute of Engineering, Att: L. R. Baker, Director, P. O. Box 1118, Detroit 31, Michigan.

ASEE SUMMER SCHOOLS FOR 1956

Construction Education. Sponsored by the Civil Engineering Division, June 29 to July 1, Iowa State College, Ames, Iowa. Information from Professor C. Martin Duke, University of California, Los Angeles, California.

Engineering Drawing. Sponsored by the Engineering Drawing Division, June 20–24, Iowa State College, Ames, Iowa. Information from Professor W. E. Street, Drawing Department, Agricultural and Mechanical College of Texas, College Station, Texas.

Humanistic-Social. Sponsored by the Humanistic-Social Division, June 28–30, Iowa State College, Ames, Iowa. Information from Dr. Melvin Kranzberg, Social Studies, Case Institute, Cleveland, Ohio.

IN THE NEWS

50th Anniversary of Co-operative Education

The 50th Anniversary of Co-operative Education will be celebrated by the University of Cincinnati, on April 19–25. Numerous authorities in science, business, and education will speak at three sessions on April 19 and 20, with the theme "Education and Industry at Work for Progress." Also featured will be a week-long industrial exhibit of displays by co-operative employers, the "Panorama of Industrial and Scientific Progress, 1906–1956." The Panorama will include the National Association of Manufacturers' traveling exhibit, "Americade." Details can be obtained from the 50th Co-op Anniversary Headquarters Office, 116 Baldwin Hall, Cincinnati 21, Ohio.

Cooperative Education Resolution

The Cooperative Education Division of the ASEE at its Mid-Winter Meeting, January 10, 1956, adopted the following resolution for publication in the JOURNAL:

Whereas, the cooperative plan of education which was originated in 1906 at the University of Cincinnati by the late Dean Herman Schneider has in the course of 50 years come to be adopted in one form or another by 35 or more colleges in the United States, and *whereas,* the Cooperative Education Division of the ASEE owes its existence to the pioneering efforts of Dean Herman Schneider and to the widespread recognition of the value of his ideas, and *whereas,* we wish to do honor to the originator of the plan and to the University where it had its inception.

Now therefore, be it resolved, that the Cooperative Education Division of the ASEE extend its sincere congratulations to the University of Cincinnati upon the 50th Anniversary of the Cincinnati Cooperative Plan; *resolved further,* that the members of this Division shall participate to the fullest extent possible in the observance of the Anniversary; *resolved further,* that we urge all participating firms and all colleges in our Division to be represented at the observance.

SECTION MEETINGS

Section	*Location of Meeting*	*Dates*	*Chairman of Section*
Allegheny	Carnegie Institute of Technology	April 27–28, 1956	J. W. Graham, Jr., Carnegie Institute of Technology
Illinois-Indiana	Purdue University	May 12, 1956	O. W. Witzell, Purdue University
Kansas-Nebraska	University of Wichita	Oct. 26–27, 1956	J. K. Ludwickson, University of Nebraska
Michigan	Wayne University	May 5, 1956	G. H. Howell, Wayne University
Middle Atlantic	Bell Telephone Laboratories, Murray Hill, N. J.	May 12, 1956	C. C. Carr, Pratt Institute
Missouri-Arkansas	University of Arkansas	April 6, 1957	L. R. Heiple, University of Arkansas
National Capital Area	Capital Radio Engineering Institute, Wash., D. C.	Oct. 11, 1955	D. C. Jackson, Jr., Aberdeen Proving Ground
New England	Tufts University	Oct. 19–20, 1956	W. S. Evans, University of Maine
North Midwest	South Dakota State College	Oct., 1956	J. W. Howe, State University of Iowa
Ohio	Ohio State University	April 27–28, 1956	E. D. Harrison, University of Toledo
Pacific Northwest	University of Washington	May 10, 11, 12, 1956	J. B. Morrison, University of Washington
Pacific Southwest	University of Arizona	Dec. 28–29, 1956	R. G. Moses, Pasadena City College
Rocky Mountain	Denver University	April 28, 1956	W. H. Parks, University of Denver
Southeastern	Tulane University	April 5, 6, 7, 1956	D. W. Dutton, Georgia Institute of Technology
Southwest	Texas Western College	March 30–31, 1956	H. K. Bone, University of Oklahoma
Upper New York-Ontario	Syracuse University	Oct. 12–13, 1956	B. H. Norem, Syracuse University

Members of the Society are welcome at all Section Meetings

GENERAL EDUCATION IN ENGINEERING

Report of the Committee for the HUMANISTIC-SOCIAL RESEARCH PROJECT

Editorial Note: A preliminary report on the Humanistic-Social Research Project was given at the last Annual Meeting of the Society in June, 1955. Subsequently a draft of the final report was prepared and circulated late in 1955 to all members of the project committee. Utilizing the comments obtained from this examination, the present "Revised Report" was developed and approved by the full project committtee early in 1956. By this time, pressure was felt to print the extensive report text, and to make it immediately available both for members of the Society and for the many other persons interested in the problems of general studies.

To make possible early publication in the JOURNAL, an unusual step was taken and the revised version was distributed in complete form to members of the ASEE General Council for approval by letter ballot. This has now been obtained, and the Report is therefore presented in this issue of the JOURNAL *for the information of the Society*. Discussion and formal action on acceptance of the report will follow at the Council meeting in June.

The present publication is in the exact form which will be presented at the Council meeting. As for any other report, comments by the Council and any amendments or changes which may be made after discussion will be published in the JOURNAL as soon as they are completed and released by the Committee.

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- Michigan State University
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- Stanford University
- University of Washington

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Historical Development of Western Civilization I and II	*Carnegie Institute of Technology*
The Background of Western Civilization I, II, III and IV	*Case Institute of Technology*
Contemporary Civilization	*North Carolina State College*
Humanities I and II	*Clarkson College of Technology*
Introduction to the Humanities	*Stevens Institute of Technology*
Cultural History of Western Civilization	*The Cooper Union*
Social Studies I, II and III	*City College of New York*
Economic Analysis and Contemporary Problems I and II	*Carnegie Institute of Technology*
Social-Humanities Sequence	*City College of New York*
The Background of American Democracy I and II	*Case Institute of Technology*
The U. S.: Men and Issues	*Massachusetts Institute of Technology*
Modern Western Ideas and Values	*Massachusetts Institute of Technology*
Public Affairs	*California Institute of Technology*
Contemporary Problems	*University of Cincinnati*
Contemporary Issues	*North Carolina State College*
The Uses of Language	*Rensselaer Polytechnic Institute*
Community Surveys	*Columbia University*
Applied Experimental Psychology	*Tufts University*
Biological Sciences	*Washington State College*

Appendix D: Sample Engineering Curricula Incorporating Humanistic-Social Sequences 735

Chemical Engineering	*Case Institute of Technology* *Clarkson College of Technology* *Massachusetts Institute of Technology* *Michigan State College*
Civil Engineering	*Case Institute of Technology* *Clarkson College of Technology* *Massachusetts Institute of Technology* *Michigan State College*
Electrical Engineering	*Case Institute of Technology* *Clarkson College of Technology* *Massachusetts Institute of Technology* *Michigan State College*
Mechanical Engineering	*Case Institute of Technology* *Clarkson College of Technology* *Massachusetts Institute of Technology* *Michigan State College*

Preface

THE HUMANISTIC-SOCIAL RESEARCH PROJECT has been financed by a grant from the Carnegie Corporation of New York to the American Society for Engineering Education. Grateful acknowledgment is herewith made to the Corporation, not only for its generous financial assistance but also for the continuing advice and encouragement of its staff, particularly Vice President James A. Perkins.

Initial impetus for the study came from the Humanistic-Social and the English Divisions of the Society. They are its joint sponsors and they have supplied the bulk of the manpower for the field work, though three engineers have also served as observers. The original Committee for the Humanistic-Social Research Project was appointed by Dean L. E. Grinter, then President of the Society, and was re-appointed by his successors in office, Dean N. W. Dougherty and Mr. M. M. Boring. The Committee, headed by President Edwin S. Burdell of the Cooper Union, is composed of engineering educators, administrators, and representatives from industry, as well as representatives from the humanities and social sciences. The Director of the Project has been Dr. George A. Gullette, Head of the Department of Social Studies at North Carolina State College. An Executive Committee composed of President Burdell, Dr. Gullette, Dr. Sterling Olmsted of Rensselaer Polytechnic Institute, and Dr. William C. White of Northeastern University has borne the brunt of the day-to-day decisions concerning the conduct of the investigation. An Editorial Sub-Committee consisting of Dr. Gullette, Dr. Olmsted, and Dean John W. Shirley of North Carolina State College has been responsible for drafting the report.

A tentative report, issued for limited circulation in April, 1955, has been read and criticized not only by members of the Committee and the field workers, but also by advisors from industry and from the liberal arts. Advisors from industry have included Mr. Kenneth A. Meade of the General

Motors Corporation, Mr. J. C. McKeon of Westinghouse Electric Corporation, Mr. W. F. Ryan of Stone & Webster Engineering Corporation, and Mr. T. J. Carron of the Ethyl Corporation. Advisors from the liberal arts, none of whom are directly connected with engineering education, were Dean Edward Y. Blewett, University of New Hampshire; Professor Kenneth E. Boulding, University of Michigan; Professor James M. McCrimmon, University of Illinois; Professor F. S. C. Northrop, Yale University; Professor Warner G. Rice, University of Michigan.

The Committee wishes publicly to acknowledge the generous reception its field workers were accorded at every institution they visited. They were received with a warmth that went far beyond the requirements of normal courtesy. We found a common bond of interest in the humanities and social sciences, a willingness to discuss problems candidly and frankly, and evidence of sincere and intelligent attempts to search with us for solutions to them. Immodesty compels us to add that we have received communications from a number of the institutions visited indicating that our field workers' presence on the campus provided a stimulus and encouragement which have already resulted in improvements in the teaching of the humanities and social sciences to engineering students.

Edwin S. Burdell, Chairman	The Cooper Union
George A. Gullette, Director	North Carolina State College
Maynard M. Boring	General Electric Company
Arthur B. Bronwell	Worcester Polytechnic Institute
John E. Burchard	Massachusetts Institute of Technology
Stuart W. Chapman	University of Washington
Carl W. Condit	Northwestern University
C. Rexford Davis	Rutgers University
Jess H. Davis	Stevens Institute of Technology
N. W. Dougherty	University of Tennessee
C. J. Freund	University of Detroit
T. Keith Glennan	Case Institute of Technology
Lee H. Johnson	Tulane University
Sidney D. Kirkpatrick	McGraw-Hill Publications
Sterling P. Olmsted	Rensselaer Polytechnic Institute
John W. Shirley	North Carolina State College
B. Richard Teare	Carnegie Institute of Technology
William C. White	Northeastern University

GENERAL EDUCATION IN ENGINEERING

Summary

The basic findings of this study are:

1. That engineering educators throughout the country are in nearly unanimous agreement that their students would profit—as professional men, as citizens, and as individuals—from a fuller acquaintance with the resources of the humanities and social sciences;

2. That a sizable number of these same educators are honestly fearful that attempts to incorporate into already overcrowded curricula a substantial program of humanistic-social studies may either jeopardize the quality of the technical education, or lead to superficiality in the treatment of the humanities and social sciences; but

3. That some thirty or more of our leading engineering schools have demonstrated such fears to be groundless by developing carefully planned programs that provide a sound introduction to the humanities and social sciences while simultaneously reinforcing the student's engineering training.

In view of these findings, our report confines itself chiefly to the practical problems that confront those who must plan, initiate, and maintain significant humanistic-social programs for engineering students. The Appendices to the report contain detailed information about the content and operation of representative existing programs. The body of the report contains discussions—and where appropriate, recommendations—concerning the problems most frequently raised by those interviewed by our field workers.

This investigation has made the Committee acutely conscious of wide variations in facilities, aims, and potentialities among engineering schools, and its most fundamental recommendation is that each institution take the steps necessary to hammer out for itself a feasible program appropriate to its own needs. No standardized pattern is, at least at present, available for mass distribution. Certain observations and recommendations, however, appear to have some general validity, and these may be summarized as follows.

Humanistic-social programs for engineering students are most successful when these conditions prevail:

1. There is vigorous administrative support for the program;
2. There is full cooperation and understanding between the engineering and liberal arts faculties;
3. The studies in the humanities and social sciences are treated as an integral part of the student's scientific and technical education;
4. Experimentation with fresh materials and methods is encouraged;
5. Advantage is taken of the increasing maturity of the student in his upperclass years.

Recommendations

Philosophy

1. The formulation of objectives must be carried out jointly by the engineering and arts faculties.
2. The humanities and social sciences must be understood as professional disciplines in their own right.
3. Engineering must be viewed as a profession with social responsibilities.

Content

1. Humanistic-social studies must be distinguished from business training.
2. A humanistic-social program must be humane as well as social.
3. Experimentation should be encouraged in:
   (*a*) Establishing functional relationships between the work in composition and speech, and the work in technical courses as well as in humanistic-social courses;
   (*b*) Capitalizing on the student's knowledge and interest in his professional fields by using materials from the history and philosophy of science and the history of technology;
   (*c*) Capitalizing on the student's interest in music and the graphic arts.

Arrangement

1. We reaffirm the recommendation of the Hammond Report for a "designed sequence of courses extending throughout the four undergraduate years."
2. Courses should be arranged to facilitate emphasis on the interrelationships that exist among the fields of knowledge.
3. Elective work must be carefully controlled to assure that it serves the purposes of the planned sequence.
4. The Engineering school should, where possible, join forces with other professional or semi-professional schools in establishing a common general education program for their students.

Administration

1. Presidents, Deans, and other key administrative officials must take the initiative in pushing for a planned program.
2. Both the engineering and the arts faculties must be brought in at the planning stage.
3. A permanent committee must be established to encourage, review, and reappraise all aspects of the work as it goes forward.
4. Special steps must be taken to assure the professional advancement of faculty members who devote a major share of their time to the humanistic-social program.

Time

1. We reaffirm the recommendation of the Hammond Report that the humanities and social sciences be given "a minimum of approximately 20% of the student's educational time. This allotment should be at least the equivalent to one three-hour course extending throughout the curriculum, and on the average somewhat more."
2. Time may be saved by exploiting both the vertical sequence and the interdisciplinary approach to subject matter.
3. Time may be saved by more careful integration of the scientific and technical work.
4. ROTC credit should not be substituted for work in either the humanistic-social or the scientific-technical stems.

Introduction

THE HUMANISTIC-SOCIAL RESEARCH PROJECT is the latest in a series of self-evaluations sponsored by the American Society for Engineering Education during the past fifty years. It is in one sense a by-product of the work of the Committee on Evaluation of Engineering Education headed by Dean L. E. Grinter of the University of Florida. In another sense it is a continuation of the work of the 1944 Committee on Engineering Education After the War, which reaffirmed the recommendations of the 1940 Committee on the Aims and Scope of Engineering Education. Both of these committees in turn drew heavily on the findings of a long series of studies conducted during the twenties and thirties and gathered together as the Report of the Investigation of Engineering Education. The current project was organized in 1954, exactly a decade after the publication of the Report of the Committee on Engineering Education After the War (popularly called the Hammond Report). Its purpose has been two-fold: (1) to consolidate and make available the experience of engineering schools during the past ten years in developing workable programs of study in the humanities and social sciences; (2) to make recommendations looking to the future strengthening of this portion of engineering education.

It early became clear that the kind of information the committee sought could not be satisfactorily obtained through questionnaire techniques, nor through the perusal of college catalogues. Instead, plans were laid to send carefully chosen volunteer observers to as many institutions as possible, in order that they might gain firsthand knowledge of various humanistic-social programs in action, and have an opportunity to discuss their operation with those responsibly concerned. These field workers met and agreed upon procedures at a two-day post-session following the annual meeting of the Society in 1954. Workers have since visited, usually in teams of two for a two day period, approximately sixty engineering schools. Detailed reports on these visits have been filed and they, together with up-to-date information supplied in writing by those institutions that could not be visited in person, constitute the basic data on which our report rests.

Each of the field reports consisted of three sections: (1) a factual section containing an objective description of the existing humanistic-social program,

its origin, development, and administration. Wherever possible, this section has been checked for accuracy with officials of the institution visited. (2) A documentary section which included committee reports, course syllabi, reading lists, examination questions and other materials that shed light on the actual working of the program. (3) A commentary section in which the field workers made a frank appraisal of the program and its operation. In order to encourage candor, workers were assured that the commentary section would be held in confidence. The other sections, however, are open for perusal, in the office of the Director, by anyone who may have a legitimate interest in them.

The kind of research here undertaken is not readily reducible to tabular form. We have been concerned with various methods of incorporating the humanities and social sciences into engineering curricula, with the formulation of objectives, with definitions of what constitutes the humanities and social sciences, with motivation, with staff problems, and with a score of similar considerations. We have, in short, been concerned with ideas, and with attempts to determine which ideas seem to work well and which do not. Obviously there are no objectively verifiable standards by which such matters may be determined. We have had to rely upon the professional judgment of engineering educators, over a thousand of whom have been interviewed. Their best thinking, as reported by competent observers, provides the basis for the discussions and recommendations in this report.[1]

We have tried to keep our attention focussed on the crucial problem of how to develop and maintain an effective program of humanities and social sciences in the very limited time usually available in an undergraduate engineering curriculum. There are many intimately related issues involving, for example, high school preparation on the one hand, and graduate study on the other, but we have felt we could perform the greatest service by resisting the temptation to touch on all facets of the problem, and giving our full attention to collegiate curricula.

Our task has been complicated by the fact that engineering schools throughout the country are at widely different stages of development in their thinking and in their practice regarding humanistic-social studies. No two institutions that we know of have identical programs. No two have responded to the Hammond Report in the same way. We have attempted to study carefully the experience of institutions that have developed what appear to be successful humanistic-social programs, in the belief that a report of their experience can be of great use to other institutions. We have also, whenever possible, visited schools where the accomplishment appears to have

[1] For those interested in a statistical study, we call attention to the 1954 Pamphlet No. 114 of the U. S. Department of Health, Education, and Welfare: *General and Liberal Education Content of Professional Curricula: Engineering*, by Jennings B. Saunders, Office of Education.

been slight, and we have done so in the belief that a sympathetic understanding of the practical problems involved is indispensable if we are to make realistic suggestions.

It should be said that in using a sampling method we are aware that we have missed some institutions where major progress has been made. Our inability to visit an institution implied no judgment whatever on the merits of its program. Nor will we in the course of this report refer to institutions by name, except in the Appendix where selected sequences and courses are described without comment. This is not because we hesitate to give credit where credit is due, but because we are extremely conscious of the individual nature of each institution's problems, and we do not want to encourage unfair comparisons. Our essential concern in this report is with ideas, and we think attention can best be focussed on them if the institutions and the individuals involved remain anonymous.

Instead of cluttering the text of the report with footnotes and quotations from the field reports, these have been included in a separate section of the Appendix. It is our hope that this separation of the discussion of ideas from the factual and critical data will make the report not only more readable, but more practically useful to administrators, faculty members, and committees who are dealing with these problems at the local level.

We have not included a bibliography, since the staff of the Cooper Union Library has recently completed a revised and comprehensive edition of *The Humanistic-Social Stem in Engineering Education,* a bibliography covering items from 1876 through May, 1955. One complimentary copy of this volume is available to each ASEE member upon application to Joseph N. Whitten, Librarian, The Cooper Union, Cooper Square, New York. Others may purchase copies at a price of 50¢ each.

This report represents, of course, the work of many hands, and the views expressed are those of no single individual. If allowances are made for the human frailty of editors, these views may be taken as a composite of the best thought of some forty educators and engineers who had before them factual information from nearly 130 engineering schools and a distillation of opinion from over a thousand interviews.

Field Workers

Bartlett, Howard R., Massachusetts Institute of Technology
Brown, C. A., General Motors Institute
Brown, Wentworth K., Rensselaer Polytechnic Institute
Burdell, Edwin S., The Cooper Union
Chapman, Stuart W., University of Washington
Christensen, Glenn J., Lehigh University
Farrell, Thomas, Jr., State University of Iowa
Fatout, Paul, Purdue University
Gullette, George A., North Carolina State College
Harman, Willis W., Stanford University
Hobgood, Alton A., Georgia Institute of Technology
Kranzberg, Melvin, Case Institute of Technology
Laity, Clifford, Montana School of Mines
Lambert, John R., Jr., North Carolina State College
Lawrence, A. A., U. S. Coast Guard Academy
Lee, John F., North Carolina State College
Lowenthal, David, Ford Faculty Fellow, Harvard University
McKean, Keith, Ford Faculty Fellow, Yale University
Mueller, Ronald H., Rensselaer Polytechnic Institute
Olmsted, Sterling, Rensselaer Polytechnic Institute
Pitman, James H., Newark College of Engineering
Shirley, John W., North Carolina State College
Shurter, Robert L., Case Institute of Technology
Stillman, Donald G., Clarkson College of Technology
Syverson, Aldrich, Ohio State University
Weeks, Robert P., University of Michigan
White, William C., Northeastern University

Institutions Visited

University of Alabama
Alfred University
California Institute of Technology
University of California–Berkeley
University of California–Los Angeles
University of Southern California
Carnegie Institute of Technology
Case Institute of Technology
University of Cincinnati
City College of New York
Clarkson College of Technology
U. S. Coast Guard Academy
Colorado School of Mines
University of Colorado
Columbia University
The Cooper Union
Cornell University
General Motors Institute
Georgia Institute of Technology
Illinois Institute of Technology
State University of Iowa
Johns Hopkins University
Lafayette College
Lehigh University
Louisiana State University
University of Massachusetts
Massachusetts Institute of Technology
Michigan State College
University of Minnesota
Missouri School of Mines
Montana School of Mines
University of New Hampshire
New York University
North Carolina State College
Northeastern University
Northwestern University
University of Notre Dame
Ohio State University
University of Pittsburgh
Princeton University
Purdue University
Rensselaer Polytechnic Institute
Rice Institute
South Dakota School of Mines
Stanford University
Stevens Institute of Technology
University of Tennessee
Tufts College
Tulane University
University of Utah
Virginia Polytechnic Institute
University of Virginia
State College of Washington
University of Washington
Washington University
Wayne University
University of Wisconsin
Yale University

Institutions Replying to Questionnaire

University of Akron
Alabama Polytechnic Institute
University of Arkansas
Bradley University
Polytechnic Institute of Brooklyn
Brown University
Bucknell University
The Catholic University of America
The Citadel
Clemson College
Dartmouth College
University of Dayton
University of Delaware
University of Denver
University of Detroit
Drexel Institute of Technology
Duke University
École Polytechnique (Montreal)
Fenn College
University of Florida
George Washington University
University of Houston
University of Idaho
University of Illinois
Iowa State College
Kansas State College
University of Kansas
University of Kentucky
Louisiana Polytechnic Institute
Lowell Technological Institute
University of Maine
Manhattan College
University of Maryland
University of Michigan
University of Mississippi
University of Missouri
Montana State College
University of Nebraska
Newark College of Engineering
New Mexico College of A & M Arts
North Dakota State College
University of North Dakota
Norwich University
Oregon State College
Pennsylvania State University
University of Pennsylvania
Pratt Institute
University of Rhode Island
University of Rochester
Rose Polytechnic Institute
Rutgers University
University of South Carolina
South Dakota State College
Southern Methodist University
Swarthmore College
The A & M College of Texas
Texas Technological College
The University of Texas
University of Toledo
University of Tulsa
Union College
United States Naval Academy
U. S. Naval Postgraduate School
Utah State Agricultural College
Vanderbilt University
University of Vermont
Villanova University
Virginia Military Institute
Webb Institute of Naval Architecture
West Virginia University
Worcester Polytechnic Institute
University of Wyoming

". . . the formulation of objectives must be carried out jointly by the engineering and arts faculties."

The Problem of a Philosophy

THE most abstract and theoretical of the problems confronting the humanities and social sciences in engineering education is also the most practical. This is the problem of defining objectives, of specifying a philosophy upon which programs may be built. Administrative arrangements, course content, staff effectiveness, adequate curricular time and the most efficient use of that time, all are directly dependent on the existence of a carefully thought out philosophy of general education that is suitable to the needs and possibilities of particular institutions. The conflicts and misunderstandings which bedevil many campuses depend ultimately for their resolution on the working out of an educational philosophy that is mutually acceptable to the engineering and the liberal arts faculties, and to which both can give their wholehearted support.

The committee did not, in fact, anticipate the confusion over objectives which it found to exist on so many campuses. More than ten years ago the Hammond Report came to grips with this problem, and made recommendations which were approved by the Society. The goals of what that report called the humanistic-social stem were stated, not in terms of subject matter, but in terms of competences it was believed the humanities and social sciences could help the students acquire:

1. An understanding of the evolution of the social organization within which we live and of the influence of science and engineering on its development.
2. The ability to recognize and make a critical analysis of a problem involving social and economic elements, to arrive at an intelligent opinion about it, and to read with discrimination and purpose toward these ends.
3. The ability to organize thoughts logically and to express them lucidly and convincingly in oral and written English.
4. An acquaintance with some of the great masterpieces of literature and an understanding of their setting in and influence on civilization.
5. The development of moral, ethical, and social concepts essential to a satisfying personal philosophy, to a career con-

sistent with the public welfare, and to a sound professional attitude.

6. The attainment of an interest and pleasure in these pursuits and thus of an inspiration to continued study.

Our study indicates that while many institutions have found this statement of objectives practical and suggestive, almost none have been able to adopt it without modification for their own programs. Instead, the usual procedure has been for a committee, or a series of committees, to hammer out a set of principles that would take into account local conditions and local needs. In view of this fact, the present report will not attempt to formulate a supplementary or competing statement of objectives, but will reaffirm, in principle, the overall objectives for the humanistic-social stem as stated in the Hammond Report. In addition, it will report on certain conclusions it seems fair to draw from its observations of the way in which successful programs of study have been initiated in the various institutions visited.

II

THE first of these conclusions is that the formulation of objectives must be carried out jointly by the engineering and arts faculties. Neither group, acting independently, is likely to define the task in a way that will win the prompt and understanding approval of the other, and our field reports are unanimous in pointing out that such mutual approval is indispensable to a successful program. We believe that the lack of a jointly formulated philosophy is the basic cause of the misunderstanding and inefficiency that was found on many campuses.

In specifying what is meant by "misunderstanding and inefficiency," we are compelled to report that the ancient war between the engineering and the arts faculties still continues in a good many institutions, particularly the larger state universities, where the two faculties are frequently separated physically as well as spiritually. The arts faculty at such institutions still cherishes a belief that the engineer is a rough, uncouth fellow wearing boots and an open flannel shirt. His intellectual equipment consists of a transit and a slide rule. He has no manners, and he wants none. He pushes jobs through by beating up his men with his bare fists. His acquaintance with the arts is limited to cheap movies, and his acquaintance with literature to comic books. He is crass, materialistic, insensitive. And it must be admitted that this picture appears to have considerable appeal for a certain type of engineer, who does nothing, in consequence, to destroy it.

At the same institutions, the engineering faculty will give evidence that it regards the typical arts man as a pale, ascetic dreamer, forever in need of a haircut. He is devoted to modern art, modern music, modern literature, and he talks incomprehensibly about all three. He is addicted to books, and

knows nothing whatever about science or mathematics. He is a thoroughly impractical fellow, probably a little pinkish politically, who gets by only because he has the gift of gab. And it must be admitted that this picture appears to have considerable appeal for a certain type of arts man, who does nothing, in consequence, to destroy it.

On the other hand, we have evidence that conflict disappears almost completely on those campuses where the arts and engineering faculties are thrown together as colleagues on an equal footing, and where there are systematic procedures for bringing the two groups together to work out their mutual problems. "To know him is to loathe him," says one character of another in the play *Stalag 17*. The committee is glad to report that this pleasant perversion of an ancient bit of wisdom does not apply to the engineer and his counterpart in the arts school. Mutual understanding breeds mutual respect. Yet the committee does not wish to sound too much like Pollyanna. Even under ideal conditions there will be warm clashes of temperament and interest, but the clashes cease to be drawn on inter-school lines. Character assassination becomes happily indiscriminate, as it should be in any well-regulated academic community!

The war between the faculties might be condoned as an example of good clean mayhem were it not for the fact that innocent bystanders too often become the chief victims. The sober truth is that the attitudes of the engineering faculty communicate themselves to engineering students. At institutions where the faculty exhibited the greatest belligerence about their colleagues in the arts faculty, we invariably found the greatest number of student complaints about the humanistic-social work. At institutions where the engineering faculty displayed a sympathetic understanding of the humanities and social sciences, student resistance to the program was at a minimum.

This whole matter of atmosphere, difficult though it may be to pin down, is of central importance in education. Though not strictly a part of a philosophy of education, it appears to be closely related, since atmosphere reflects the philosophy under which the institution operates. Perhaps it is not too far-fetched to say that the college environment conditions the future intellectual development of the young man in the same way that the home environment conditioned his emotional development as a child. In both instances, the basic attitudes of those around him are communicated indirectly, by subtle signs and clues dropped in the course of conducting quite ordinary affairs. If the engineering faculty are to hope for a maximum return from the time invested in a humanistic-social program, they must help provide a climate of opinion congenial to all serious intellectual inquiry. And the arts faculty, on its part, must display an understanding of and respect for the rigorous discipline involved in scientific and technical education. Neither of these necessary attitudes can be successfully faked, and this is but a further reason for our insisting that the point of departure for any genuinely useful col-

laboration between the two faculties must be the establishment of systematic means of communication. Only thus can a workable philosophy be achieved and permitted to flourish.

III

THE second conclusion to be drawn from our observation of how programs were initiated and planned consists of a series of warnings. We think there are at least three obvious dangers against which all planners should be on guard. They are:

A. The danger of defining the function of the humanities and social sciences too narrowly.
B. The danger of defining their function too superficially.
C. The danger of defining their function too ambitiously.

Because the humanities and social sciences *do* contribute to the professional competence of the engineer, there is a tendency in some schools to limit their function to the improvement of technical efficiency, or at least to justify them on narrowly utilitarian grounds. It is argued that an engineer should be able to write well and speak effectively, that he should be able to win friends and influence people, that he should understand business problems and operations. Therefore he should take courses in composition, technical writing, speech, applied psychology, and business administration. On the same basis some schools have attempted to justify the traditionally humane disciplines of literature and philosophy as subjects which will enable the engineer to manage people more effectively as a result of an improved ability to analyze their motives and points of view. It is easy to understand why arts faculties have sometimes fallen prey to this rationalization. By using these tactics some have probably achieved a hearing for courses which would otherwise have been neglected.

The committee believes that the humanities and social sciences are, in a deeply serious sense, practical and useful. It believes that engineering educators have performed an invaluable service to liberal education by their stubborn insistence that contemporary relevance is the standard by which to judge any humanistic-social program. What we object to is an essentially frivolous definition of practicality that limits its attention to the development of a few surface skills, while failing to recognize that literature and philosophy and social organization are, like science itself, basic aspects of human activity in which depth of understanding provides the only sound foundation for the student's further growth. The emphasis upon immediately useful techniques narrows the scope of the humanities and social sciences and seriously diminishes their educational value. No small part of the job of any teacher in the humanities and social sciences is to develop in his students some appre-

ciation of the nature and the value of the disciplines they represent. If he himself either conceives them, or has allowed himself to be trapped into rationalizing them, in an essentially false and narrow way, it is difficult to see how he can persuade his students of their genuine worth.

Perhaps even less defensible is the view which regards the humanities and social sciences as a cultural veneer designed to make the engineer acceptable in polite society. This finishing school concept of general education not only fails to justify the inclusion of liberal arts courses in an engineering curriculum; it makes them look positively ridiculous. From this standpoint, literature and the arts are primarily conversation pieces, or aids to smoother family and social relations since they give the engineer something to talk about besides transistors, strain computations, and fluid flow. Carried to extremes, this attitude leads to the expectation expressed on one campus that the humanities and social sciences should inculcate good manners and teach students not to walk four abreast on campus walks, nor to attend classes without neckties. The comment which has already been made about the narrowly utilitarian point of view applies with even greater force to the superficial one. A statement of objectives which fails to respect the centuries of solid scholarly accomplishment represented by the humanities and social sciences can scarcely provide the requisite intellectual framework for a sound program of study.

On the other hand, an overstatement of what may reasonably be expected from the humanities and social sciences, while proceeding from entirely different motives, may be equally dangerous. Implied in some of the glowing statements the committee has examined is a faith that a few courses in the humanities and social sciences can provide health and emotional adjustment, personal and social success, clarity of thought, moral integrity, civic responsibility, aesthetic sensitivity, professional vision, and in general a kind of serenity and wisdom we had thought was reserved for Providence alone. The objectives which some schools profess to accomplish in courses involving twenty-one to twenty-four semester hours would appear to rival, or even to outstrip, what might be expected from a full four-year liberal arts program. The committee doubts that grandiose statements of good intention serve any very useful educational purpose. On the contrary, they are likely to lead either into self-deception, or into frustration and disillusionment.

IV

THE third conclusion the committee draws about the formulation of an adequate philosophy is that it must be based upon a broad view of the potentially professional character of engineering, as well as on a responsible view of the values that are inherent in the humanities and social sciences. In the education of the professional engineer, the function of the humanities

and social sciences should not be limited to the improvement of communication skills and the development of amiable employees. The engineer is a responsible professional man, whose every professional act has human and social consequences. Whether he is aware of it or not, he is instrumental in the creation of a new society and a new economic order, as well as a new physical environment. One result of his professional accomplishments is that he is being called upon to accept an increasingly responsible role as a leader in his community.

To meet his growing responsibilities and to realize his capacities as a human being, the engineer needs both professional competence and a broad understanding of himself and of the world in which he lives. He needs depth, flexibility, and a capacity for growth in directions which we ourselves can today only dimly visualize. Like other professional men, he does not graduate from college with a completed education. The job of engineering education is to provide him with a foundation upon which he may build a career of genuinely professional stature.

Given this view of the engineer as a professional man and as a human being, the humanities and social sciences can take their place as an integral part of his total education. They do not stand apart from the rest of the curriculum. They support the scientific-technical training, and are in turn supported by it. They contribute to professional competence not merely in the narrowly vocational sense but in the broad sense of enabling the engineer to see his own activities in their human and social contexts, to understand his own objectives, methods, and problems in relation to the objectives, methods, and problems of men engaged in other activities.

But the humanities and social sciences have a function to perform which goes beyond even this broad concept of professional development. For the engineer, as for all men, they represent the heart of our inherited human experience. The humanities—whether they are thought of as specific disciplines (literature, music, art, philosophy, and history), or as a record of man's intellectual, cultural, and emotional development—are concerned primarily with individual awareness, the knowledge of self, of the condition of man and of the quality of human experience. The social sciences, considered either as specific disciplines (economics, history, political science, sociology, anthropology, and sometimes psychology), or as a record of social and political development, are concerned primarily with man's relations with his fellows.

If the social sciences are not quite sciences, they still stand with the natural sciences as continuing evidence of man's stubborn determination to exert control over his own destiny through reason and understanding rather than force. And it should be particularly rewarding for the engineering student, trained as he is in the physical sciences to respect exact quantitative measurement, to confront some of the complexities that arise when it is human

rather than atomic behavior that is being studied. This point need not be labored, however, since the committee found that, in general, engineering faculties were favorably disposed toward studies in the social sciences, particularly economics. What was not so apparent was a similarly high regard for work in literature, philosophy, and the fine arts.

The committee believes that any philosophy of general education that fails to take account of the function of the humanities is wholly inadequate. The humanities are uniquely concerned with ends rather than means, with goals rather than methods. In religion and art, in literature and philosophy, the student is compelled to confront the big and ultimate human problems: What are we doing here? Where are we going? What is the good life? What is man that anyone is mindful of him? No profession and no individual can hope to achieve a sense of purposeful direction while ignoring these questions, nor while ignoring the great monuments to the human spirit that have been achieved as men have sought answers to them. The committee believes that a sound humanistic-social program for engineering students must be humane as well as social.

V

WHAT has been said so far has been, as we indicated it must be, fairly theoretical and abstract, yet it reflects one of the fundamental findings of our total study, namely, that where we found inadequate programs, confusion, indifference, and even hostility, the difficulties seemed always to stem from the fact that responsible members of the faculties involved had never threshed out together a mutually acceptable understanding of what the humanistic-social program was expected to accomplish. It should perhaps be added that institutions that have worked out a basic philosophy and a reasonably specific statement of objectives have found both to be strangely impermanent. As programs have grown and experience has increased, both the philosophy and the specific objectives have changed. This we believe to be not only inevitable, but a sign of genuine educational development. The committee would not want to be understood as subscribing to the view that a theoretical statement of principle, arrived at in advance of the practical applications, will automatically cure all educational ills. This would be patently unrealistic, for, as one of the critics of our Tentative Report argues, "We are studying here not a static process but an essentially dynamic and continuing process in which the objectives are continually modified as they are compared with experience, as well as providing a criterion by which experience itself is judged and modified."

The committee urges only that this dynamic process is imperative for a successful humanistic-social program, and that it must get started in joint dis-

cussions between the engineering and the arts faculties. We have also warned of certain pitfalls which such discussions ought to avoid, the pitfalls of a too narrow, a too superficial, or a too unrealistic definition of the task assigned to the humanistic-social stem. Finally, we have suggested that as preconditions to the shaping of a philosophy and the specification of objectives, there must exist a long-range view of the future of the engineering profession, and an understanding of the great reservoirs of human experience which the humane and social disciplines can offer to engineering students.

"The proliferation of content in all fields, while a remarkable human achievement in itself, is also one of the most frightening aspects of our disturbing age."

The Problem of Content

If this report is to be as practically useful as it hopes to be, something must be said about the subject matter which a sound program in the humanities and social sciences should contain. The committee is quite aware of the hornet's nest it may here be stirring up. Any liberal arts man worth his salt believes that what he teaches is the most important thing in the world. He has, after all, chosen to devote his life to it and ordinarily has done so after careful deliberation. It will surprise no one, therefore, to learn that historians tend to feel that more attention should be paid to history, philosophers argue for more philosophy, and political scientists are convinced that what is needed is more study of political science. Yet it is transparent that the range of possible courses is so vast, and the time available so short, that no engineering student can possibly take all the work that is thought by one or another of the representatives of the liberal arts to be of supreme importance. Some choices must be made.

The committee is conscious that many harried administrators throughout the country would welcome a firm and specific decision as to what those choices should be, but such a decision is clearly outside our province. Moreover, we would not, if we could, attempt to dictate in detail the subject matter content for any program, for the traditions, the facilities, and the relative academic strength of the several disciplines vary enormously from institution to institution. We can, however, reiterate certain principles that have already been mentioned in connection with objectives, and then discuss some developments within the subject matter fields that seem to us important enough to be brought to the attention of local committees which will have to make decisions about content. We also call attention to Appendix B of this report, which contains representative samples of humanistic-social programs now in actual operation in various types of institution.

II

One principle to be followed in determining content was enunciated over ten years ago in the Hammond Report: "Discriminate between humanistic studies and business training." The present committee has already reiterated

that warning, not because it holds any brief against courses in accounting, business law, patent law, business administration, personnel management, etc., but because it believes that the broad objectives that have been established for the humanistic-social program are not likely to be achieved through the addition of courses that are semi-professional in intent and emphasis. It may be pointed out that an increasing number of engineering schools are making available to their students options that combine engineering and business training and these seem to the committee to be meeting a very real need. The sole point we make is that business training must not be confused with humane and social studies that serve quite different educational purposes.

Another principle is that some reasonably equal balance must be sought between work in the humanities and work in the social sciences. Both are important, but they are not identical and we have already noted a tendency on the part of engineering schools to weight their programs unevenly in favor of the social sciences. In the long run we believe this will prove to be a mistake, and we recommend that planners make a conscious attempt to provide something like equal experience in both areas for all students.

III

One of the most interesting, though perplexing, parts of our investigation was the attempt to discover what changes, if any, in content and approach are observable within individual courses when these courses seek to achieve the objectives of the Hammond Report. It is perfectly obvious that when engineering educators agree that their students should have more acquaintance with literature, philosophy, history, economics, and the other humanities and social sciences, they have scarcely scratched the surface of the problem of content. What kind of literature, and taught with what emphasis, toward what ends, and by what means? What kind of history: American? European? Oriental? Ancient or modern? Cultural or political? Questions like these are not readily answerable, particularly in the midst of a period of educational change and experimentation like the present one.

There is something ironical in the fact that engineering educators have turned for additional assistance to their colleagues in the liberal arts at the very time that the liberal arts themselves are undergoing a critical re-examination, particularly with respect to their function in general education. This is a time of ferment for the humanities and social sciences, and the committee's job is not made easier by that fact. The discussions which follow are, however, an attempt to make easier the job of those who must make the practical decisions in curriculum planning. Touching as they must upon many hotly debated educational issues, the discussions themselves will be open to criticism (as has been amply evidenced by comments on the tentative version of this report). The committee believes that it must take that risk,

but would like to make clear that it is not pretending to make an exhaustive analysis of all aspects of the general education problem. It seeks only to call attention to certain developments that it thinks are of special interest to engineering educators.

1. The first objective listed in the Hammond Report was the achievement of *"an understanding of the evolution of the social organization within which we live and of the influence of science and engineering on its development."* This clearly calls for a consideration of the place of history in the curriculum. As we have already indicated, history is of many varieties. The commonest courses taken by engineering students are American History, World History, and Modern European History, the last mentioned usually beginning with the Renaissance and dealing with American developments from the eighteenth century on. Several states require a course in American History of all students in state-supported institutions, or at least have a state requirement which a course in American History will satisfy. On the other hand, we found a few institutions that prohibit the use of American History as a means of meeting the humanistic-social requirements, not because of any objection to the content, but because so many students have had a considerable amount of American History in high school that it is felt they particularly need the enlarged view which it is hoped World or European History will provide.

The content of world history courses would make an interesting study in itself, for they exhibit in miniature the same pressures, and require the same hard decisions, that the whole humanistic-social program does. The subject matter of world history, after all, is everything that has happened in the world up to the present moment. Obviously, considerable selection is necessary. Yet, before mentioning some of the principles of selection, it should be pointed out that two expansionist tendencies were noted. Many historians have felt that the traditional western civilization course is too narrowly provincial and does not prepare students for an understanding of the Orient, or of the new powers that are bound to be forced upon their attention by the march of events in the decades ahead. A second expansionist tendency has been to push back into pre-history in order to take advantage of the accumulating body of anthropological data, and to give students some sense of the enormous time span involved in man's struggle to establish himself on the earth—a span in which the four or five millenia of recorded history become relatively insignificant.

Confronted with the clearly impossible task of surveying the whole domain of world history, a growing number of institutions have adopted what is rather inelegantly called the "block and gap" or the "posthole" approach. This means that the attempt to cover in chronological order even a highly selected portion of the material is abandoned, and instead certain crucial periods in history, selected because they are thought to have particular relevance to our own time, are studied intensively. Thus a student may start

with Athens in the fifth century, B.C., jump to Europe in the thirteenth century, A.D., move to sixteenth century England, eighteenth century France, and end up with twentieth century America. Two of our leading engineering schools have developed two-year courses on this plan, and have exploited its potentialities beyond anything we know of in similar courses for liberal arts students.

Another development in the teaching of history to engineering students deserves special mention. A fairly sizable number of institutions are beginning to pay considerable attention to the history of science and the history of technology or engineering. Sometimes separate courses are offered, sometimes the material is incorporated in a world or European civilization course.

Our field workers report, and both they and our advisors display, a difference of opinion as to the value of this development. There are those who feel that it marks an unjustified adaptation of course materials to the supposed needs and interests of a special group of students, and must lead inevitably to a distortion of historical perspective. The place of science and technology in the development of civilization should not, of course, be ignored, but to single them out for special attention is not only historically unsound but may defeat the major purpose of a history course, which is to demonstrate the interconnections and interrelationships that exist among the various forces that shape any society. Also, this view is apparently influenced by the belief that the humanities and social sciences should provide engineering students with an experience as distinct as possible from their technical work, and this can scarcely be done if science and engineering remain the focus of attention.

On the other hand, there are those who see in this development not only a pedagogical device useful in interesting engineering students in historical studies, but a needed corrective to our habitual historical perspective. Science and technology have been too long neglected as fundamental determinants of our whole way of life. According to this view, the first systematic history, as it developed in the eighteenth and nineteenth centuries, was essentially political largely because those for whom it was intended were public officials, or persons preparing themselves for participation in public affairs—an example would be the British universities preparing young men for various administrative posts throughout the empire. After Spencer and Marx, in the middle of the nineteenth century, attention was more and more focussed on the social and more particularly on the economic forces in history, and this emphasis exactly corresponded with the growing importance of the business man in western society. Now, it is pointed out, the scientist and the engineer are becoming the dominant figures in our society, and history is again shifting its attention, this time toward science and technology.

This clash of views is not of the sort that this committee can, or perhaps should, attempt to resolve. The Hammond Report calls for some attention to

"the influence of science and engineering" on the development of our social organization, and our study indicates that such attention is frequently given. Our reports indicate further that student response to this emphasis is good. The committee feels justified in concluding that here is a development of special interest and importance for engineering education, that it is a development which should be encouraged, but that there are possible dangers of overemphasis and distortion that must be guarded against.

2. The second specific objective proposed by the Hammond Report is concerned with several of the social sciences. It calls for *"the ability to recognize and to make a critical analysis of a problem involving social and economic elements, to arrive at an intelligent opinion about it, and to read with discrimination and purpose towards these ends."*

At least one course in economics is a standard requirement in almost all engineering curricula, apparently because it is thought of as the most practical of the social sciences and also because it is commonly prerequisite to later courses in management and business administration that are taken by large numbers of engineering students. So far as content is concerned, the movement in the last two decades, if we interpret it correctly, has been away from a purely institutional approach and toward a national income approach with more emphasis given to distribution, methods of growth, and an analysis of the functions of any economic system. From the point of view of the objectives of a humanistic-social program, this development seems to us healthy.

A similar development is apparent in political science or government courses. The emphasis would appear to be shifting from a description of the institutional relationships of federal, state and local governments to a more realistic study of the various forces, like political parties and pressure groups, that have evolved to get the work of representative government done. Increasing attention is also being paid to foreign policy and our growing responsibilities as a world power. There can be little doubt that these emphases are better meeting the needs of engineering students.

Sociology and anthropology, which were once thought of as parts of the same discipline, show signs of splitting apart. The sociologist has a great deal to offer the engineering student in the analysis of urbanization and its problems, as well as in shedding light on social stratification and motivation. The anthropologist is coming to have more in common with the social historian, and as we have indicated, his findings are being incorporated into a number of civilization courses normally taught by the history department.

Courses in social psychology tend to overlap with those of sociology, both groups providing insights into the evolution of social organization. Psychology courses that begin with physiology and deal in some measure with depth psychology provide some corrective to the lack of biological study which is characteristic of most engineering programs. Courses in personality development, marriage and the family, applied psychology, etc., would seem

to us to correspond to the more highly specialized applied courses in engineering, which must often be sacrificed if a sound grounding in fundamentals is to be the objective.

3. The third specific objective listed in the Hammond Report is *"the ability to organize thoughts logically and to express them lucidly and convincingly in oral and written English."* Here the committee found the greatest expression of dissatisfaction with actual results, possibly because results, or the lack of them, are more readily detectable here than they are in most other fields. From all parts of the country came the now standard complaint that students could not read or write adequately, and could not express themselves orally with either clarity or precision. Alumni groups and spokesmen for industry are almost unanimous in pressing for more work in English—meaning always writing and speech. Yet the non-technical studies in many engineering schools already consist almost exclusively of work in communication skills, with perhaps a course in economics as the sole concession to the remaining aims of a humanistic-social program.

The most disturbing factor in this whole "English problem" is the staggering discrepancy between effort and results. Students normally begin their schooling with a reasonable command of the English language, acquired primarily from the home. They then study English in one form or another continuously throughout the elementary and secondary grades, or for a total of twelve years. Yet it is a commonplace that colleges regard this preparation as inadequate, and the freshman English course is the closest thing we have to a universal requirement in collegiate education. On top of this, engineering schools commonly add a speech course or two and a course in technical report writing. But the complaints of inadequate proficiency still pour in.

Obviously, something is deeply wrong here, either with our definition of what it is we are trying to accomplish, or with our way of going about it. If the same amount of time and money and manpower were devoted, with such apparently disappointing results, to the teaching of any other subject in the curriculum, it would be regarded as a national scandal. Fortunately, it is not the business of this committee to solve this problem, but we can scarcely ignore it when we find in institution after institution that the lion's share of the time set aside for the humanities and social sciences is taken up by work in composition and speech. And the implications of even this assertion must be carefully qualified, for we found that, while some freshman English courses were nothing more than routine and mechanical reviews of grammar, others were obviously among the most imaginative and humane courses on the campus.

The committee recognizes that the English problem is not peculiar to engineering education, yet it suggests that engineers might well take the initiative in sponsoring a thorough-going and hard-headed study of the whole

complex matter. In the present investigation we made no such study, and will therefore merely call attention to certain principles that seem to be emerging from the many practical attempts to grapple with the problem at the local level.

The first is that students seem to fare better when they are asked to write and speak about significant subject matter that engages their interest. The usual "book of readings" that has become standard equipment in many composition courses, while often lively and provocative, characteristically covers the whole range of human interests in order to provide something for everybody. The explanation for its use is "to give students something to write about." It strikes the committee as startling that, with the humanities and social sciences being slighted for lack of time, the composition courses should be groping for "something to write about." One institution we visited was using an Anthropology text in composition, with apparently good results. Another institution has put the composition work in the junior year when students are not only more mature, but have taken enough courses so that they do not lack for theme subjects. Several institutions are now experimenting with tackling the reading, writing and speaking problem as an integral part of the whole humanities sequence. The communications skills are being developed as students grapple with ideas in the subject matter disciplines. And in some institutions this process has been extended to include the scientific and technical courses. Such experiments appear promising not only because of the functional treatment of communication, but also because of the continuing attention which is paid to these skills over a period of years and in all aspects of the student's education. The engineering faculty has its part to play in the development of competence in writing and speaking.

A second type of experiment is based on the idea that the communication work should be different from high school work in English so that the student may get a fresh look at the subject, on a more mature level. The tendencies here are to incorporate in communication courses material on semantics, logic, propaganda analysis, and critical thinking; or to consider writing and speaking in terms of purpose and function, emphasizing organization and style rather than grammatical correctness, and supporting verbal communication with work in graphical and pictorial communication; or to combine reading and writing by concentrating, for example, on the similarities and the differences between scientific prose and imaginative literature. These attempts would seem to get around the no-subject matter difficulty, and if they can be planned as an organic part of the whole humanistic-social program, they may provide useful answers to the two problems at once.

4. The fourth objective of the Hammond Report called for *"an acquaintance with some of the great masterpieces of literature and an understanding of their setting in and influence on civilization."* As a result of its

study, the committee believes that this recommendation needs to be defined more carefully and expanded to include the non-verbal arts.

At least one course in literature is a standard requirement in many humanistic-social programs. But literature is a broad term. What kind of literature should the engineering student study, and what specific goals should such a course aim at? Literary documents may be studied as historical records—as products of the social and intellectual milieu out of which they grew, or conversely as influences upon the social and intellectual development of a society; or they may be studied as types—the novel, drama, essay, lyric, etc.; they may be studied as a part of the history of ideas, exhibiting as they do the various attitudes and beliefs that men have held about God and nature and man and his destiny; they may be studied as forms of art to be enjoyed for their own sake. This list is not complete, but it may suggest that there are decisions to be made beyond the preliminary one of whether any literature at all is to be included in the program.

As nearly as our field workers could determine, the literature courses that were most successful with engineering students were those that emphasized ideas and values, as opposed to those that emphasized form or historical significance. It did not seem to make much difference whether the literature was American, British, or Greek, so long as it dealt with important ideas and was aesthetically valuable in its own right. We were told by many literature teachers that engineering students seemed particularly adept at the analysis of ideas but were less likely than other students to enter into the creative experience that is so important a part of the reading of imaginative literature.

This observation connects with another that was made by independent field workers at a surprising number of institutions. It was that, for reasons that no one is quite sure of, engineering students tend to show an exceptional interest in and understanding of music. Where opportunities are provided, engineering students play music and listen to music and discuss music, with an enthusiasm that sets them apart from most other students. Several observers reported also that painting and the visual arts seemed more congenial to engineering students that did literature. How much these impressions, insofar as they are valid, reflect a general tendency in the new generation, and how much they are peculiar to engineering students, we do not know. For our purposes it is enough to call attention to the potential interest in non-literary arts, and to suggest that those responsible capitalize on it whenever possible.

5. The fifth objective suggested in the Hammond Report was *"the development of moral, ethical, and social concepts essential to a satisfying personal philosophy, to a career consistent with the public welfare, and to a sound professional attitude."* This objective, broad and general as it is, presents special problems. The committee believes that it cannot be realized merely by adding courses in religion and ethics to the curriculum. In particular the

question of inculcating in aspiring engineers the highest standards of professional ethics would appear to be a joint responsibility of the arts and engineering faculties, with the latter shouldering the major share of the burden. If the engineering faculty do not, by precept and example, show the importance of professional ethics, it is unlikely that a course in ethics taught as part of the humanities sequence will do the job.

Courses themselves will necessarily vary from institution to institution. It is clear that a number of church-connected schools will require courses in religion as a result of their basic religious orientation; and the committee believes that these courses frequently supply many of the values that in secular institutions are sought by humanistic-social programs. The committee was especially impressed with the fact that in some church-related institutions time was provided in the curriculum for both a fairly comprehensive program in the humanities *and* a four year sequence in religion. State supported institutions cannot teach religion in the same way, and must seek elsewhere for ways of giving meaning and coherence to the total educational experience. Field workers have reported, however, an increasing interest in religion and philosophy on campuses all over the country, and the committee urges that this fact be taken into account by faculty committees concerned with program planning.

A few general observations on specific courses and devices may be useful. Much philosophical material is, of course, being incorporated into humanities courses and civilization courses. The committee feels that the historical approach to philosophy can probably be handled better in these general courses, where ideas are placed in context, than it can be in the usual history of philosophy course. The problems course in philosophy appears to have considerable appeal, probably because of its immediacy, and because it can, in part at least, be related to the student's knowledge of the sciences, giving that knowledge a significance which he has not suspected it had. One instructor reported that engineering students are startled to discover that the Second Law of Thermodynamics may have philosophical implications.

More specialized courses in the philosophy of science also seem to be gaining in popularity, and field workers found at one institution some interest in the philosophy of technology. The development of such courses goes hand in hand with the increased attention being given to the history of science. We believe both should be encouraged. One word of practical advice would seem justified by our interviews, and that is that the history of science appears successful even when taken in the earlier years, while the philosophy of science would better be delayed until the student is more mature and more fully acquainted with mathematics, physics, and chemistry.

6. The final objective listed in the Hammond Report, *"the attainment of an interest in these pursuits and thus of an inspiration to continued study,"* does not refer to a particular body of subject matter, but it does enunciate

a general principle which is often overlooked. The committee believes that in all the humanistic-social work the objective must be not "coverage of subject matter" but development of interest and enthusiasm *together with* sufficient knowledge that the student may continue his reading at his leisure and with some confidence that he knows what he is doing. It is important that instructors, impressed with the vastness of their subject matter and armed with their hard-won learning, take care not to overwhelm their students with demonstrations of their own erudition. The instructor must, in effect, select the most advanced and significant concepts in his field, get them into language which non-majors can understand, and see to it that students use them until they become part of their intellectual equipment. And he must take care that students experience some success in this process as they go along, or he may lose them long before his task has been accomplished.

IV

Faced with the many complicated problems we have been describing, it is not surprising that some schools are attempting what some educators may regard as radical experiments in combining subject matter fields and emphasizing unifying concepts of the broadest sort in an effort to equip the student with conceptual bridges between traditional fields. The committee believes that work of this kind should be encouraged. There are bound to be some failures, but the problem which these men are attacking is probably the major intellectual problem of our time. The proliferation of content in all fields, while a remarkable human achievement in itself, is also one of the most frightening aspects of our disturbing age. Attempts to find unity and meaning within it should be applauded, not derided. The committee believes that even such new and relatively undeveloped concepts as information theory, game theory, and organization theory should be thoroughly explored for their possible unifying value. Engineering students who are themselves moving out to the frontiers of knowledge deserve to be taught by men who are alive to new ideas and are able to demonstrate by personal example that no man's education may ever be thought of as completed.

"The basic device that appears most promising . . . is the four-year vertical sequence. . . ."

The Problem of Arrangement

FROM what has already been said about content, it should be apparent that the order in which subject matter is presented, and the ways in which the various courses are related to each other, are questions of crucial importance. The committee believes that a student's experience with the humanities and social sciences will be more meaningful if it is a continuing one, and that he should acquire not merely isolated facts and skills but a sense of progression, and of interrelationships. His experience should be cumulative, not a series of unrelated explorations in different directions. Course should build on course, concept on concept. Only in this way can the student's humanistic-social education be given a depth comparable to the depth which already exists in the scientific and technical part of his work.

The committee strongly reaffirms the recommendation of the Hammond Report for a *"designed sequence* of courses extending throughout the four undergraduate years." That Report continues, "No existing formulation of means—of educational programs and procedures—has as yet proved to be fully adequate. . . . We believe that a year by year development of such means is one of the most important tasks before this Society."

In the years that have elapsed since the Hammond Report laid down this charge, a great deal of carefully planned and broadly conceived experimentation with designed sequences has been undertaken, and it is now possible to say that answers, both general and specific, to four basic questions of curriculum design are beginning to appear. These questions are:

1. *The question of structure:* How should the courses be distributed throughout the curriculum?
2. *The question of integration:* To what extent should courses be integrated and coordinated? What appear to be the most effective ways of integrating and coordinating?
3. *The question of adaptation:* To what extent should engineering students be treated differently from other students? In what ways can material be adapted to the needs and interests of the engineer?
4. *The question of election and diversification:* To what extent should the selection of a curriculum be in the hands of the student? To what extent should specialization be permitted or encouraged within the humanities and social sciences?

The committee believes that a discussion of these questions will give rise not to a single arrangement of courses, but to a wide variety of carefully planned curricula, each suitable to the needs and resources of a particular institution. Curriculum planning, after all, is much like house planning. A good plan must take into account the needs of those who will occupy the house and the characteristics of the locality in which it will be built. It is nevertheless possible to set up certain design principles which will be applicable everywhere. This the committee has tried to do in the following sections.

II

THE most specific question, and the one to which the clearest answer can be given, is that of structure. The basic device that appears most promising in meeting the central problem of adequate content in inadequate time is the four-year vertical sequence recommended by the Hammond Report. In one form or another, this simple but potent structural device is now in use at some twenty engineering schools. The advantages of the sequential arrangement have nowhere been fully exploited, but already very substantial progress has been made, and the committee urgently recommends that all institutions give this plan serious consideration.

A four-year vertical sequence (or a five-year sequence in five-year programs) means that the courses, usually one each term, are arranged in an ascending order from the freshman through the senior years. Many, though by no means all, curricula are able to allot this much time in addition to freshman composition. Such an arrangement has at least the following potential advantages:

1. It assures continuing contact with the humanistic-social fields from the moment the student enters college until the day he graduates. He does not "get off" his general education requirements in the first two years and then, with a sigh of relief, proceed to departmental specialization. Instead, the humanistic-social work becomes a normal and integral part of his total undergraduate experience.
2. Each course can build upon its predecessors, thus permitting some systematic, consecutive development over a period of years. Junior and senior courses can be taught at junior and senior levels, capitalizing on the greater maturity of the student, to the obvious gain of both student and instructor. A collection of merely introductory courses may, therefore, be avoided. Moreover, the most serious danger of all general education courses—the danger of superficiality—can in some measure be obviated if the later years of the sequence are properly planned.

3. Broad basic courses taken by all students may be combined in the sequence with elective courses that push more deeply in some direction of the student's choosing.
4. Finally, the planned sequence encourages everyone concerned to pay attention to interrelationships. Each course may be planned as part of a total scheme, building on what went before, preparing for what comes after. Even if the sequence is made up of traditional courses, the departments involved must decide what comes first and what follows, and each offering is bound to be affected in some measure by the logic of the total pattern. Where encouragement is given to the development of new courses, each gains strength by an understanding of its purpose in relation to the rest of the offerings.

Better motivation, better balance, avoidance of unnecessary repetition (but encouragement of useful repetition), systematic planning of the total program—all of these are potential advantages in the vertical sequence that compel the committee to see it as the most promising instrument yet devised for insuring an efficient use of the time available for work in the humanities and social sciences. The practical evidence from our field trips bears out this view. The most stimulating and forward-looking programs we studied took advantage, almost without exception, of the vertical sequence.

Having indicated our conviction that courses should be related one to another, cumulative in their effect, and extended throughout the entire curriculum, we should like to call attention to two fairly common arrangements that seem to us not to take sufficient advantage of the possibilities inherent in a planned sequence. These are: (1) the required sequence of standard courses in the various disciplines; and (2) the free elective system. Both of these schemes have serious defects as solutions to the problem of providing an adequate experience in the humanities and social sciences. Introductory courses intended for majors in the various fields are too frequently vocabulary courses designed to prepare the student for later course work. They were not planned with the non-major in mind and they are not likely to provide him with what he needs. Engineering educators who are inclined to disagree with this point should ask themselves whether the first course in their several engineering sequences would be of much use to the liberal arts student who wanted to get some general understanding of mechanical, electrical, or chemical engineering. Another difficulty with the introductory course in the four-year sequence is that it does not take advantage of the growing maturity of the student. A series of freshman or sophomore courses is likely to prove uninteresting to the upperclassman, and give to the humanities and social sciences a reputation for being elementary and inconclusive when compared with advanced technical courses.

The difficulties with the free elective system will be discussed more fully later. It is clear that an elective system need not be a mere series of introductory courses. The real difficulty is that the elective system need not be anything in particular. A free elective system shifts the burden of responsibility to the student. If there is good counselling and an adequate choice of carefully designed courses the results may conceivably be good. But the odds against its being a really meaningful sequence are so great as to raise serious doubts that the uncontrolled elective system is the most desirable arrangement.

If the committee's analysis is correct, the answer must be found somewhere in the wide range of possibilities which lie between uncontrolled election and a prescribed series of unrelated courses, in other words, *in a planned sequence which is partially or wholly integrated, or correlated, or otherwise brought into some meaningful arrangement.*

III

No planned arrangement of courses (or, for that matter, of units within a course) can avoid the problems of integration. The process, if not the name, is a commonplace in all educational endeavor. The technical curricula in engineering are integrated, as every use of calculus in physics, or every application of a physical principle to a specific technical problem indicates. This is also true, though perhaps to a lesser degree, of the humanities and social sciences. When the Hammond Report asks that engineering students be given not only an acquaintance with some of the great masterpieces of literature, but "an understanding of their setting in and influence on civilization," it is calling for an integration of historical and sociological with purely literary knowledge. In other words, if integration be thought of as meaning those pedagogical adjustments that must be made when the departments of human knowledge are used as instruments for undergraduate instruction rather than convenient divisions for purposes of research, then no serious educators can be opposed to integration *per se;* such quarrels as exist are really about what form integration should take.

Our committee distinguished four major types of integration, each of which appears to be educationally sound if properly handled. These are:

1. *Vertical integration,* or the correlation of consecutive courses in such a way that one course builds on the facts, concepts, or methods developed in previous courses. In this type of integration the traditional disciplines may be presented in separate courses, but there is a conscious attempt to relate one course to another.
2. *Horizontal integration,* or the correlation of the work in one course with the work in another course which is being taken

concurrently with it. Since in engineering education this ordinarily means correlation of humanistic-social courses with scientific and technical courses, in other words adaptation, it will be discussed in a later section of this report.

3. *Interdisciplinary integration,* or the drawing together into a single course or series of courses of the principles and data from several fields of knowledge. The commonest examples are:

    a. Courses in the humanities which draw upon literature, philosophy, music, painting, architecture, and the other arts.
    b. Courses in the social sciences that draw upon economics, political science, psychology, and sociology.
    c. Civilization courses of various sorts which draw upon both the humanities and social sciences, and even on the natural sciences.

4. *Integration of purpose,* or the use of one course to accomplish several basic objectives. Most common are the attempts to provide facts and concepts and certain skills at the same time; to put composition, for instance, into a subject matter course, or to use a composition course to teach students something about logical method and critical evaluation.

The committee believes that these various types of integration all have their uses. It also recognizes that most of them have their dangers and problems. A frank discussion of these problems should make the real educational issues clearer.

The most conservative of the schemes is, of course, *vertical integration.* Historians teach their history courses, economists teach their economics courses, literature people teach their literature courses. The values of each discipline are preserved, and the separate departments remain intact. In this situation the major problem is to insure that some coordination does actually take place, that there is in fact an integrated sequence and not just a series of courses which are related to each other on paper and nowhere else. The plain fact is that it often takes a major revolution to jar a faculty member out of a well-worn departmental rut, and the development of a correlated sequence may not be enough of a revolution. Professor Smith may still continue to teach Smith 1 and Smith 2 regardless of the fact that the catalogue now talks about Social Science 1 and Social Science 2. Nevertheless the correlated vertical sequence may be the only feasible solution in many schools. The committee believes that it can be made to work if sufficient effort is put into the job. It also suggests from a practical point of view that the development

of an interdisciplinary course or courses as a capstone to a supposedly correlated sequence will often result in a closer coordination of courses at the lower level. The single interdisciplinary course will require members of different departments to work and think together in a way quite different from that which usually takes place in a committee meeting. It will also set up a focal point toward which other courses will gradually be oriented.

The *interdisciplinary sequence* is a much more radical solution. The committee believes that the interdisciplinary sequence holds great promise, and that continued experimentation should be encouraged, but it warns that the evidence is not all in, and that the extent to which several disciplines may profitably be brought together for teaching purposes has not been established with any certainty. The complete reshuffling and re-thinking which must take place in an interdisciplinary course or sequence of courses practically insures that something new will develop. Whether that something is good or not will depend in large measure upon the ingenuity and the sincerity of the people involved. In some of the courses which the committee examined, there seemed to be a serious loss. If the student's only acquaintance with the arts is through a civilization course, for instance, he may come to think of works of art simply as documents in the history of a civilization and lose all sense of their relevance as immediate experience. This is not an inevitable result of such a combination, but it is a real danger. Interdisciplinary courses, furthermore, make heavy demands on the instructor. He can no longer rely on the notes he took in his last graduate seminar, and he must explore fields of learning outside his own specialty. For some teachers this in an insurmountable obstacle. For others it appears to provide an intellectual challenge that makes a career in engineering education more attractive than any other. The committee would here urge that if such desirable instructors are to be retained, vigorous and clear-cut administrative arrangements must be made to insure their academic and professional advancement.

Courses which attempt to *combine several purposes* also require comment. It is perfectly clear that there is a limit beyond which such combinations cannot go. Given so many hours for class work, and so many hours for preparation, only a certain amount can be done. The committee can conceive of a course in surveying, for instance, which would deal with the whole history and theory of measurement, would break over into the law of property, and would end by raising the most penetrating questions about man and his uses of the earth; it doubts, however, whether the student would get much practice with the chain and transit. But this extreme example in no way invalidates the idea of combining various purposes in one course. Many courses are thought of as giving students either skills and techniques, *or* facts and ideas, *or* new interests and attitudes, *or* new experiences. Yet several of these purposes may often be skillfully combined in a single course without in any way weakening the value of the course. Why should writing and speaking, for

instance, be taught only through skill courses in composition, speech, or communication? Why should students not learn to write and speak while they are writing and speaking about a particular body of subject matter? The committee found many examples of this kind of integration, some of them apparently quite successful: a community survey project, for example, which gave students experience in analyzing a total community, required them to talk with a great variety of people, forced them to apply principles of economic and social analysis and also made report writing and speaking in conference situations a functional part of the entire project. Other programs integrate writing and speaking with humanities courses and sometimes with technical courses as well. Others include in composition courses text materials which provide an introduction to later work in the humanities and social sciences. Others use courses in language to compare the methods and attitudes of the scientist and engineer on the one hand and the artist on the other. In all these arrangements there are clearly two dangers: (1) that the skill portions of the work may actually be neglected; and (2) that the combination may be unnatural, forced, or confusing.

IV

WHATEVER the kind of integration, success involves a re-thinking of subject matter on the conceptual level. It is not enough just to throw things together in new combinations. There must be some kind of intellectual framework which will give meaning and continuity to the whole experience. The committee cannot report that it found any single, generally accepted intellectual framework applicable to the whole of the humanities and social sciences. But it did find a number of promising concepts in actual use with apparent success. Among these are the following:

1. *Historical-cultural concepts,* as in many civilization courses.
2. *Concepts of form and function,* as in many courses which attempt to combine the various arts, and even other forms of communication, into a meaningful whole.
3. *Concepts of socio-economic structures,* as in courses which see all human activity reflecting itself in social organization.
4. *Concepts of man.* These may range from evolutionary and anthropological concepts to strictly religious ones.
5. *Concepts of method,* as in programs which compare the methods of one field with those in another.
6. *Problem-solving concepts* which may begin with the notion of man as a problem-solving animal and relate all his activities to this idea, or may concentrate on major issues of the past and present.

This list is by no means exhaustive, but it reflects the serious level at which engineering educators are struggling with this difficult intellectual problem. Out of careful experimentation may well evolve a variety of usable and interrelated concepts comparable to the basic concepts which already exist in the natural sciences. Experimenters must, however, recognize the pitfalls which surround such an undertaking. Most serious of these is perhaps the tendency toward premature commitment to a particular set of concepts. The committee believes that there is as yet no satisfactory unified field theory encompassing the humanities and social sciences, yet on some campuses men who have won through to useful integrative concepts have become so enamoured of them that continued research has ceased. It is the old story of the revolutionary turning conservative. On the other hand, there is the opposite danger that the instructor in his zeal to remain impartial, and tentative, and open-minded will end up communicating no principle by which affairs may be judged. He may become so flexible as to be, in Irving Babbitt's phrase, positively invertebrate.

V

A FINAL word must be said about the idea of deferring the real synthesis, the real integration, until the end of the program. We have already said that we believe the capstone course may be a useful integrative device ond also a useful means of achieving greater coordination among departmental courses. In some schools this final synthesis takes place in an interdisciplinary course. In others it occurs in what is essentially a philosophy course. In still others a Contemporary Civilization course, or a Great Issues course, may be used to draw the various threads together.

In the face of such variety, why not turn the job over to the students? In talking about integration on our field trips we constantly ran into the argument that integration was all right but after all it must take place in the mind of the student. This is such an obvious platitude that we would not mention it if we did not believe that it is actually being used to the detriment of necessary developments in some programs in the humanities and social sciences. Of course integration must take place in the mind of the student if it is to be effective. So must all learning. And there is furthermore no single integrative principle. Integration must, nevertheless, be prepared for, and arrangements must be found which will encourage it to take place. The mere placing of two related facts within the same consciousness does not, strangely enough, insure that that consciousness will in fact relate them. This should be clear to anybody who has watched what students do, or rather do not do, with mathematics and physics in their engineering courses. The *idea* of relationship must be established. Integrative concepts must be used until they become familiar. If this is done it is possible that students can be

left to take further steps in integration on their own, as their experience grows. This is one of the things we mean when we say that true education is a lifetime process.

VI

Is the engineering student a distinct species? Should he be treated differently from other students? Should the arts departments be asked to develop separate courses especially designed for him?

These questions we asked everywhere we went throughout the country, and the responses they evoked were frequently quite violent. They also revealed one of the basic splits in thinking between the engineering faculties and the arts faculties, because on the whole the engineers were favorable to special treatment, while on the whole the arts people were not. "Any request for courses other than those developed by the arts department for arts men is a request for adulteration and is to be resisted to the death," a liberal arts department head is quoted as saying to our field workers. "If the engineers want culture they can come and take what the arts college offers." In fairness, it must be added that a minority of engineering faculty spokesmen appear to share this view, though usually on the ground that the benefits to the engineering student of rubbing elbows with contemporaries whose interests differ widely from his own far outweigh such advantages as stem from courses designed with engineering students in mind.

On the other hand, it is precisely this attitude on the part of the arts faculties which has driven a number of engineering schools to establish their own humanistic-social departments, or their own departments of English, or to use other less radical devices for getting the kind of instruction they seek for their students. The evidence from this study is that when this is done the results are gratifying, at least to the school of engineering. At one institution where a department of English and Humanities had been an integral part of the engineering school for over thirty-five years, we were informed in no uncertain terms by the engineering faculty that they proposed to continue the arrangement for at least the next hundred years. We must report also our observation that at the institute type of engineering school, where the humanistic and social science departments deal almost exclusively with engineering students and in consequence readily adapt their courses to the needs and interests of such students, complaints about the humanistic-social work were at a minimum.

We confront here, then, a problem of considerable gravity. Our evidence indicates that courses specially designed for engineering students are in the main successful, at least in winning the support of the engineering faculties and the engineering students. On the other hand, such courses are usually violently opposed by the departmental representatives of the humanities and social sciences. In addition, the administrative problems involved can be-

come very serious indeed, and we can scarcely blame a university administration for shuddering at the thought of separate departments, or even separate courses, for each of the professional and pre-professional schools on the campus. Furthermore, the professional careers of arts men who join such captive departments are often jeopardized, and it is not easy to maintain a top-flight faculty. In view of these considerations, the committee must regard the establishment in the school of engineering of separate departments for teaching the humanities and social sciences to engineering students as a device of the last resort, to be adopted only as a solution to extreme local conditions.

Whatever the administrative arrangements may be, however, the educational issues raised by attempts to adapt the subject matter of the humanities and social sciences to the needs of engineering students are fundamental, and the committee believes that a certain amount of frankness is required if they are to be satisfactorily resolved. Some fifteen or twenty years ago there was a considerable rash of courses in Engineering English, Engineering Economics, Engineering Psychology, etc. It is our opinion that many of these courses did represent attempts to water down the subject matter and soften up the grading for the sake of engineering students. There is evidence that many courses in Engineering English, for example, were established because too many engineering students were failing freshman composition. Whatever the facts, such courses at least got the reputation of being devices for lowering standards, and it is this reputation that lies behind much of the violence of the opposition to adapting courses to engineering students. Perhaps the engineering faculty can better sympathize with this point of view if they consult their own opinions about courses in mathematics for business administration majors, courses in physics for nurses, or courses in chemistry for arts students.

This committee vigorously opposes any attempt to devise courses for engineering students that do not meet the highest academic standards. It calls attention to the bad repute which courses in the humanities and the social sciences with the prefix Engineering have acquired. It suggests that the prefix be abandoned in proposals to and in discussions with the arts faculty, and that particular pains be taken to demonstrate to the arts faculty that when special attention is sought for engineering students this does not mean a request to lower standards. There is certainly no need for it; engineering students are among the ablest on any campus, and at several institutions we ran into the complaint that the trouble with the liberal arts courses was that they were too easy, too leisurely for engineering students who were accustomed to heavy assignments and to systematic work schedules. One advisor informed us that he was an enthusiastic supporter of the humanistic-social program and that he required all of his students to take at least one course in these fields each term. But his reason was not entirely reassuring. It

was that he felt his students were carrying such heavy and exacting loads that they deserved some recreation, some soft spot in the schedule where they could relax and loaf a bit. While this is admittedly an extreme example, we believe that, whatever may have been true in the past, the pressures now for courses designed with engineering students in mind come from the dual desire to get better motivation and to pack more real substance into the limited time available.

If the usual introductory courses in English Literature, History, Economics, Philosophy, Psychology, etc., were consciously designed as general education courses for the non-specialist, a great deal of the demand for special treatment for engineering students would be removed. What leads to this demand is not so much the feeling that the engineering student is a separate species as it is the feeling that he is most certainly never going to major in the humanities and that usually the course he takes is the last formal exposure to the subject matter he is likely to get. He frankly seeks what the intelligent layman ought to know about the subject involved. Yet too often the initial courses are designed, either consciously or unconsciously, as introductory to later courses taught by the same department. It is assumed that the student will go on to additional study, and this seriously affects the nature of the offering. Most of the members of the department involved started in the field the same way, and this accounts in part for their feeling that any other way is bound to be inferior. What is forgotten is that they did go on to advanced work, while few engineering students ever will.

Fortunately, this situation is now becoming generally understood, and fortunately also, the engineering student is not alone in his need for a terminal course designed to provide a layman's understanding of a given subject. It has been estimated that even in a great university over eighty per cent of the work of the English department is in service courses for non-majors, and the ratio will probably go higher.

It appears to this committee, however, that most general education programs devised with arts students in mind, admirable though they may be, still possess two defects from the point of view of the engineering school. First, they seldom take cognizance of, or advantage of, the scientific and technical interests of engineering students. Second, they usually require considerably more time than the average engineering curriculum is willing to spare, although in this respect there are several notable exceptions where engineering students are, with apparently good results, taking the same general education program that is required of arts students.

This situation suggests a long range solution that appeals to the committee as both feasible and desirable. It is to join forces with other professional and pre-professional groups on the campus whose problems are at least roughly comparable to that of the engineering school. Pharmacy, nursing, business administration, forestry, agriculture, textiles—the list will vary at

different institutions, but on most campuses there is a considerable body of students with much the same problem: crowded curriculum, scientific and technical and practical interests, yet with a real need to possess themselves of the values and insights which the humanities and social sciences can offer. Administrations that would understandably shrink from the prospect of special courses and special programs for every special group, will find it more reasonable to visualize a single general education program designed (with room, of course, for individual variations) for all professional and pre-professional groups.

We are glad to report that moves in this direction are already apparent on several campuses. Where the engineers have established workable and attractive humanistic-social programs for their own students, other schools are asking to come in on the program. Local political and administrative considerations sometimes prevent it, but the possibilities are there, and it seems to the committee that this is a practical direction in which to move. So long as the engineers take the lead, the interests of their own students will undoubtedly be taken care of, and in addition they will come to receive some of the benefits of working with students in fields other than their own.

This solution seems to us to hold promise not merely because it solves some practical problems, but also because it rests on the sound assumption that engineering students are not a separate species. There is every reason to believe that the difficulties of incorporating a sound humanistic-social program in the various engineering curricula are as acute as they are in any of the other professional or pre-professional curricula. As progress toward a solution is made in engineering, therefore, adaptation or modification with other groups in mind should not prove too difficult.

VII

The committee has already indicated its objections to uncontrolled election as a solution to the problem of providing engineering students with an understanding of the humanities and social sciences. But there is a vast difference between uncontrolled election and controlled or planned election. There is unanimous agreement that a certain number of hours of work in the humanities and social sciences should be required. But there is less agreement about what portion of this work should be planned by the student and what planned by the faculty, or the related question of the desirability of diversifying programs in the humanities and social sciences vs. the desirability of encouraging specialization even in the limited time available.

Present practice throughout the country ranges from one extreme to the other, with what we judge to be the most successful programs striking some compromise in which one or two or even three basic courses are required of

all and the student is then allowed some election. After careful consideration, your committee concludes that while a certain amount of election may serve a useful purpose, the advantages of a *planned sequence* of courses are so overwhelming that *only electives which are a part of the plan should be allowed.* This is so important (as well as controversial) a recommendation that we feel some obligation to explain in detail the reasoning that lies behind it.

Those who argue for a maximum of free election do so on several grounds. There is what may be called the *argument from democracy.* This takes two forms. Negatively, it is argued that it is undemocratic and authoritarian to impose any rigidly prescribed pattern on free students. More positively, it is argued that if students are to become mature members of a democratic society, they must learn to make their own choices and accept the consequences. In this view, even their mistakes form an important part of the educational process.

A second position may be called the *argument from individual variation.* According to this view, the great variety of student interests and aptitudes should be recognized and encouraged. Attempts to fit everyone into the same dull mold should be resisted. Furthermore, it is argued, the motivation is better in courses the student himself elects. There is always a certain amount of natural resistance to being told what you have to do, and the vitality of the educational experience suffers in prescribed courses.

But the most serious argument for maximum election rests on quite different grounds. This may be called the *argument from too much knowledge.* Starting from the undoubted fact that vastly more knowledge is available than any one man can now in a lifetime assimilate, and that any running survey of it can lead at best to superficiality, at worst to total confusion, holders of this view maintain that students should acquire as full and penetrating a knowledge as possible of at least one area outside their field of specialization and that the choice of area should be their own.

The committee recognizes that these arguments have merit, and believes that no system of requirements in any educational institution should be so stubbornly administered that adaptations to individual needs cannot be made. It assumes that all recommendations contained in this report will, if accepted, be subject to wise and flexible interpretation and administration. But it also believes that an uncritical acceptance of the principle of election is now undermining much of the usefulness that can reasonably be expected from the humanities and social sciences.

The argument from democracy seems to us essentially specious. The engineering student has exercised a choice in selecting engineering and also in selecting a particular branch of engineering. But having done so he has committed the planning of his strictly technical work very largely to a faculty. If his education is a whole unit, however, and the humanities and

social sciences are a structural part of it, it follows that the sequence of courses in these subjects should also be planned. We suspect that some at least of the argument for a maximum of free election is really based on a feeling that the problem cannot be solved by the faculty anyway. It is too complex; there are too many variables. But if the faculty with its experience cannot solve the problem, how can it expect the student to do so when he often barely knows what the course names in the catalogue mean?

The argument from individual variation and the argument from too much knowledge are, however, more serious. If the student can make a wise choice, he may feel better satisfied, better motivated toward the course he has selected, simply because he has had a chance to do the choosing. And it is certainly true that concentration in a particular field will give the student a better sense of at least one non-technical subject than he could otherwise acquire.

While the committee opposes uncontrolled election, it recognizes the possibility of limited or controlled election as a planned part of a planned program. Such election, it feels, should begin only after the student has had two or three years of carefully coordinated work so that he will have some idea of what he is actually electing. And the electives themselves should be thought of and planned as approximately equivalent paths to similar general goals. Given reasonably specified objectives and several courses that may reasonably be expected to lead to these objectives, there is no reason why the student himself should not be allowed to decide which course most appeals to him. We must, however, report our observation that the conditions just stated are very seldom present in the day-to-day operation of most elective systems. The actual criteria used in choosing electives appear all too often to be convenience in scheduling, rumors of easy assignments, high grades, and similar less-than-academic considerations. It is apparent that if limited elective systems are to fit the need for planned curricula, they must be scheduled in such a way that mere convenience does not become the basis for a choice, and they must be planned so that they not only do roughly equivalent jobs but also make comparable demands upon the student. This is a difficult operation, but not, the committee thinks, an impossible one.

Candor forces us to admit that one of the arguments for controlled election has less to do with the needs of the student than it does with the desires of the faculty and the problem of getting and keeping good instructors. In routine or elementary programs (and there are many of them) many faculty members prize very highly the privilege of giving an elective course which will diversify their own programs and give them contact with more mature students. Much of this problem is solved for teachers in coordinated or integrated programs, but even in these, there are individual faculty differences which it may be well to recognize.

One final word about election: At a number of institutions, electives in the humanities and social sciences are in competition with electives in tech-

nical subjects. This amounts to letting the student decide not merely which humanistic-social course he will take, but whether he will take any. We believe that such a decision should be in the hands of the faculty. Even where a free elective system is favored, the minimum number of hours to be taken in the humanities and social sciences should be specified. (Where this has been done, our field workers report the growing use of a fascinating addition to the lexicon of educational jargon. Courses which a student takes to meet the humanistic-social requirement, but which he himself is permitted to choose, are called *required electives!*)

". . . the full support of both engineering and arts faculties will produce programs more imaginative and effective than those envisaged by any single individual."

The Problem of Administration

THE importance of the administration in initiating and fostering a workable humanistic-social program can scarcely be over-emphasized. Although curriculum development is one of the traditional prerogatives of the faculty, jealously guarded in most institutions by faculty committees and by faculty control over curricula, it is our observation that vigorous administrative leadership and backing are always necessary. At every institution where a lively program is under way we found that there had been one or more administrative officers—presidents, deans, department heads—who had worked hard in laying the groundwork and in seeing to it that the necessary faculty discussions were pushed forward. At institutions where little had been done, it was usually apparent that the key administrative officials were not seriously interested. One of our field reports contains the following terse summary:

> Increasingly it strikes the present writer, as it has his team mates, that the key to the Humanistic-Social situation *anywhere* is the top Engineering administration. If this administration wants progress, it will take the steps (sometimes painful) necessary to produce it; if the administration is satisfied with the *status quo*, nothing is going to happen.

The administrative problems will, of course, vary widely with the type of institution involved, affecting as that does the fundamental relationship of the engineering and the arts faculties. They will vary too with the nature of the administrative arrangements within the engineering school itself—with the question of whether the departments are strong and autonomous, for example, or whether curriculum is planned on a school-wide basis. Faced with these obvious practical variations, the committee can do only what it has done in earlier sections of this report, namely, set down certain principles that seem to emerge most clearly from our study of how programs were initiated, encouraged, and developed in various types of institution.

The basic principle, which has already been made clear by our earlier comments, is that administrative arrangements must be aimed constantly at getting joint support for the program from the engineering and the arts faculties. The engineering group can sap the strength of the program unless it understands its purposes and feels itself to be identified with its progress.

The arts faculty can sabotage, consciously or unconsciously, the best laid plans, if it feels its interests and its point of view have not been consulted.

Joint planning is easier to accomplish on paper than it is in actuality. Our observations would lead us to believe that patience as well as administrative skill is required. Faculty members are notoriously independent characters (Carl Becker has defined a professor as a man who thinks otherwise), and time is required if they are to be brought together in a concerted effort on a common enterprise, particularly if that enterprise involves, as it frequently does in this case, unorthodox arrangements of courses and subject matter. It is not accidental, we think, that humanistic-social programs seem to be more highly developed in the independent technical schools than elsewhere. The essential reason is that in such institutions the engineering and arts faculties are more closely identified, and the departmental structure of the humanities and social sciences is less strong than it is in the large university system.

Yet the problem of developing interest in a sound humanistic-social program is essentially the same problem that faces the engineering administrator in other aspects of program development: how to get the faculty to consider the problem seriously and with enthusiasm. The committee found, however, that the problem of the humanistic-social program is particularly complicated in that there are two faculty units to be considered in the planning, and that both must be drawn into the deliberations early if success is to be achieved.

How this is to be done depends upon the basic administrative pattern of the institution, and here, of course, real differences were found. The problem in the large university with separate schools of engineering and arts, both relatively autonomous, is a far different one from that of the technical school where the functions of the humanistic-social departments are more clearly defined. Part of the difficulty appears to lie in the different modes of thinking of the two faculties; part of it appears to be due to the lack of close liaison between the two groups. Our study has shown, however, that independent work by either group is not readily accepted by the other, and if a split appears, battle lines form, opposition to the program becomes fixed, and the results are negative. Both units must accept the program with some enthusiasm.

Reports of field workers indicate that the most common cause of unsuccessful programs is unilateral planning by the engineering faculty. Too often the responsibility for program development has been given to a planning committee or curriculum committee of the school of engineering, and the arts faculty has been ignored. In this event, even though the arts faculty members have been called in for consultation, a resentment is likely to develop which may grow into overt opposition. Ways must be found to insure that the

people responsible for the teaching in the program feel that they have had a genuine part in the planning so that there is a real identification of faculty with the program they are teaching.

Various schools have solved this problem in various ways. In some instances the general education portion of the curriculum has been planned on an institution-wide basis, following the recommendations of a general faculty committee, usually appointed by the president. If the recommendations really come from a good faculty committee, this method usually succeeds in enlisting faculty interest and support. However, this approach means that no special program exists for the engineers, and it is usually this group, of all the schools, which is least sympathetic with the total program. Only in institutions with a long history of liberal tradition will the engineering faculty enthusiastically endorse such a general program, detached from the professional program with which they are intimately connected.

II

WHERE a special program designed for engineering students is sought, the methods of achieving it again depend upon the organization and relationship existing between the two faculty groups. Where the humanistic-social faculty is a service unit closely connected with the engineering faculty, no serious problem exists. The two groups are already closely allied in interest, and joint deliberations are relatively easy to arrange. Where, however, the two separate faculties exist under independent administrations, and with separate objectives, the problem becomes more complex. The committee has seen two solutions, both of which appear to work if carefully handled. If relations on the higher administrative levels are congenial, it is usually possible for the dean of engineering and the dean of arts to get together on the appointment of a joint committee to study the problem and to make recommendations to both faculties. If the gulf between the two schools is wide, the dean of engineering may (with the approval of the dean of arts) detach an interested and sympathetic man from the arts faculty and assign him to the problem of organizing a joint committee for planning and operations in this area. Extreme care must be exercised in choosing this liaison man: he must be a person whom both deans trust implicitly, and he must have sufficient personal stature and professional reputation to be respected by both the engineering and the arts faculties.

Once joint discussions are underway in a serious manner, the administrators should leave the faculty to carry on with the development of the program. Assistance should be given when requested, but the major decisions, if they are to be convincing to the faculties, must be made by the faculties. Our reports carry numerous instances of bad feeling generated because the joint committee was not permitted to function as a committee, but was ex-

pected to endorse a previously-planned program sprung full-blown from the brain of the dean of engineering or of arts. In this regard, the committee is more convinced than some deans seem to be that the faculties are both willing and able to carry on an assignment as important as this. Our study indicates that the full support of both engineering and arts faculties will produce programs more imaginative and effective than those envisaged by any single individual.

Though the administrator must rely on the faculties for planning, he cannot relax his interest in overall ends and means. As various programs now in existence testify, there is some tendency on the part of faculty committees, when the pressure is relieved entirely, to act hurriedly to get the job done, or to let the deliberations degenerate into political bartering at the expense of both the educational philosophy and the interests of the student. Curriculum planning, with so many possible channels open to explore, is a difficult assignment, and there is no easy solution. The administration must keep a watchful eye on the deliberations, and be always ready to reiterate the major objectives of the program and to remind the faculty that education is designed for the student rather than for the convenience or tradition of the faculty.

Formulation of a coherent and effective program is difficult enough, but the major task of administration comes after the program is initially adopted and put into effect. Every means must be employed to create an atmosphere in which the program can flourish and to follow through on its continued development and improvement. A reorganization of the teaching personnel, to be discussed later, may be necessary. At the same time, the program must remain under continued scrutiny to see that the objectives are being met as effectively as possible. If necessary, the program must be modified to meet the objectives, or the objectives must be reconsidered in the light of actual experience with the results.

This reconsideration of program and objectives is again essentially a faculty function. In this review, as in the planning, general faculty identification with the success of the work is indispensable. If the program developed breaks into units, it is administratively essential that some one individual be responsible for each unit. But the faculty must fit the parts into the whole and see that they continue to function in the role for which they were established. This calls, in most institutions we visited, for a continuing joint faculty committee—an advisory committee or an operating committee, usually the original planning committee with some changes to include teaching personnel from the program—to carry out the necessary continued evaluation. How much authority is to be vested in this committee depends entirely upon local traditions and the difficulty of their problems. But again experience with actual programs has shown that this is not a perfunctory committee to be casually appointed. Where the committee review has been intimate, including discussions of texts, class visitation, student interviews, and faculty

discussions, the program has been dynamic and increasingly effective. Where the committee has been detached or uninterested, the program has tended either to ossify or to break up into unrelated parts, losing entirely its central objectives.

Countless other difficulties will arise to plague the administrator, but most of these will be connected with the central problem of how to get and hold the most effective teaching faculty possible for the humanistic-social program. The committee holds that next to planning, staffing poses the major problem of administration.

III

No matter how carefully a program may be thought out, it is obvious that it cannot achieve the desired objectives if the instruction is poor or indifferent. The committee does not join those who feel that the content of the program is immaterial so long as the instruction is good. We have already indicated our belief that planning is vital and that subject matter drawn from the humane and social disciplines is indispensable to the education of the professional engineer. But we must add that imaginative and sympathetic instruction is equally indispensable.

Engineering schools here confront a practical problem of considerable magnitude. How can they attract and hold able and inspired instructors in the humanities and social sciences? The dilemma may be simply stated: if a separate staff is recruited (whether attached to the school of engineering or not) the instructors involved must ordinarily sacrifice, or at least jeopardize, their professional futures in the special departments in which they have been trained. If, on the other hand, the staff is drawn from established departments with other interests, there is bound to be, at best, a division of interest and loyalty, at worst, an overt resentment at being asked to teach undergraduate engineers. If the program has been planned jointly as we have recommended, this dilemma may not be too serious, though it is still to be considered.

Our investigation shows, as anyone might have anticipated, that the best instruction comes, with few exceptions, from a staff that understands and likes engineering students. Very little is accomplished by an instructor who wishes he were doing something else, or who regards himself as a martyred missionary among technically-minded Philistines. Rare indeed (not more than two or three on a large campus) are the exceptionally great teachers whose appeal is universal, and who can educate in spite of every adverse condition. As a result of its investigations, the committee is convinced that *able and enthusiastic instructors can be obtained if they are afforded professional careers comparable to those they might enjoy in an established and specialized department.* Salary and tenure must, of course, be comparable, but the committee holds that these are not the decisive factors. More im-

portant are the opportunities for professional growth for this segment of the faculty—opportunities for experimentation, research, and personal development.

It appears to the committee that schools of engineering possess largely unexploited resources for attracting to their courses top-flight men in the humanities and social sciences. The special problems of teaching the humanities and social sciences to engineering students provide an attractive challenge to the right kind of instructor. Further, many of the ablest men in the humane and social disciplines are deeply perturbed by the critical problems the human race is facing. They may feel that our technology has outrun our mastery of the social skills, and that unless the full impact of our humane and social knowledge is brought to bear on the scientific and technological leadership of our civilization, civilization itself is doomed. The opportunity to influence the young men who will so obviously be in positions of critical responsibility tomorrow is one that will attract those most deeply devoted to the values inherent in the humanities and social sciences. If satisfactory arrangements for professional advancement can be made, such an opportunity will seem to many to be more attractive than the prospect of a career devoted to producing scholars more or less in one's own image. A large number of instructors in the humanities and social sciences who deal exclusively with engineering students informed us that they had no desire to return to the arts college where the students were already essentially in agreement about the value of liberal studies. The engineering student, who demands that the values of the humane and social disciplines be demonstrated, proved more stimulating.

The instructor in the humanistic-social program must feel that he is working in a program worthy of the disciplines he has been trained in, and that he is developing personally and professionally by his participation in it. He must not see himself as sacrificing his own interests by doing work which is of secondary importance or is rewarded as if it were. Success in teaching in the humanistic-social program merits and must receive professional recognition. The administration of the program proposed for each institution must be carefully thought out to provide these rewards; the teacher of engineering students must not have his academic fate left solely in the hands of a department whose major interests lie elsewhere.

The needs of the humanistic-social program, content-wise, indicate that several types of research not normally embraced by specialized departments may be stimulated. Research on the effectiveness of the program—of its contents, of its concepts, of its impact on the students—could have an immediate value which the researcher could observe. Some of this research could be conducted by every individual teacher; some of it by every contributing department. Research in experimental courses and approaches to general education under controlled conditions could also be stimulated among

the faculty. A dynamic program of research and evaluation can help to strengthen both the courses and the staff.

Many faculty members will prefer a more academic approach to research, but the humanistic-social program provides new fields of investigation here, also. If an approach on an integrated basis is made, as the committee recommends, there are countless areas in which much real scholarship must be expended before the basic problems of interrelation are solved. Here the mature scholar is brought face to face with the limitations of his knowledge, and must explore new areas with real insight and understanding. Usually he must read widely and wisely in at least one allied field, and he must knit together the best that is known and thought in both areas. Research into the relationship of apparently diverse ideas should attract and challenge the best scholarly minds, and stimulate the kind of teaching that the humanistic-social program must have if it is to awaken the minds of young engineers.

There are a number of institutions in which the liberal arts faculty have only undergraduate engineering or science students to deal with, and in consequence are compelled to sacrifice the stimulus of teaching advanced courses and graduate students. Where this is true, special incentives to continue writing and research may be necessary. Travel funds to permit attendance at the meetings of professional societies need to be supplied. One institution reports that monthly meetings of the humanities staff at which papers are read and discussed has proved helpful, with the staff itself providing the sort of stimulus a seminar is supposed to provide.

Nothing that has been said about the opportunities for special research that are available to the man who teaches humanities or social sciences to engineering students should be taken as meaning that the normal and traditional fields of scholarship are in any way closed to such a teacher. Our suggestion is only that additional challenging possibilities open themselves to the arts man on an engineering campus. In this connection we must report the comment of the head of a chemistry department in a technical school where no degrees in chemistry were granted and very few on his staff had any direct contact with graduate students. He had built what was obviously a superior staff, most of whom were actively engaged in research and had enviable lists of publications. When asked how this was accomplished in the absence of the usual academic stimuli, he reported that he was careful to explain the circumstances to each new member of the staff, adding that full facilities for research were available and every stimulus to research provided, with the single exception that the staff member would have to do his own research instead of letting graduate students do it for him!

Still another need is felt by the serious teacher of the humanities and social sciences: he must establish a close relationship with some of his students and be able to see his influence on their thought. There is still some carry-over of the old master-apprentice relationship which cannot be ignored when

the stimulation of the faculty member is being considered. Some few individuals can derive satisfaction from lecturing to a sea of anonymous faces day after day, but these are unusual souls. Most teachers like students and want to know them and follow their growth and development. It is this instinct which leads to gasps of horror or laughter when teaching by closed-system television is first broached at a faculty meeting. And it is probably true that much of the best teaching is done on this man-to-man basis; school after school reiterated its faith in the "good teacher", and when pressed came down to this close association of faculty member and student as the heart of the matter. When programs are devised and schedules arranged, each instructor should be given some work involving relatively intimate contact with his students—at least one small discussion group where he can bring the full impact of his scholarship and wisdom to bear on students whom he understands and likes.

To sum up, the staff assigned to teach in the humanistic-social program must be well trained professionally, alert, and, above all, interested in the problems of teaching engineering students. Instructors should be granted time for research and deliberation, and should have direct contact with some small number of students for the intellectual satisfaction of both. These professional opportunities, beyond salary and tenure considerations, should be more than adequate to insure a diligent and enthusiastic teaching faculty for the humanistic-social program.

"Reorganizing an academic curriculum is like trying to move a graveyard."

The Problem of Time

In previous sections the committee has made a number of recommendations about philosophy, course content, course arrangement, and administration. But it has not yet tackled the question which to many appears of supreme importance: how much time will all this take, and where is the time coming from? The committee is inclined to discount the significance of these questions and to relegate them to last place in its consideration, but many correspondents have indicated that this is the one thing they want to know, and they want not a general answer but a specific one. They will not be satisfied with the statement that if the humanistic-social program is truly worthwhile, time will be found to accommodate it.

On the other hand, the committee feels strongly that tables setting forth data on median contact hours and the percentage of time allotted to humanistic-social studies, based on the evidence we have, might not only be meaningless, but actually misleading. In the first place, we think the significant thing is not credit hours, but the proportion of the student's total time devoted to work in the humanities and social sciences. We have very little evidence on this crucial matter. Second, the diverse methods of calculating contact and credit hours, varying ways of computing the hours required for graduation, substitution of ROTC credit for humanistic-social work, plus uncertain information about what is required and what is optional at many institutions, all conspire to make such figures as we have unreliable. Finally, definitions of what constitute humanistic-social studies vary so widely that any quantitative statements are bound to be deceptive. Our field workers were instructed to accept in each institution that institution's own designation of what constituted humanistic-social courses. Designations, as we expected, varied widely, and included, in one institution, ROTC classwork, in another a course in electrical engineering taken by mechanical engineers. In view of these considerations, it seems to us that the reasonable thing to do is to restate a principle and hazard a generalization.

The present committee reaffirms the basic recommendation of the Hammond Report that the humanities and social sciences be given "a minimum of approximately 20% of the student's educational time. This allotment should be at least equivalent to one three-hour course extending throughout the

curriculum, and on the average somewhat more." Our evidence indicates that a majority of schools do not measure up to this standard, and that even when every course that anyone chooses to call humanistic-social is included, the national average is something less than 17%. (See also the study by the U. S. Office of Education, referred to on page x, which concludes that 17% is approximately the correct figure.)

Far more important in our opinion than a statistical report on the *status quo* is the presentation of concrete suggestions about time. We believe the problem of time can best be discussed under three headings: (1) the efficient use of time within the humanities and social sciences themselves; (2) the efficient use of time in engineering and science courses; and (3) a realistic handling of the ROTC problem.

II

THE committee has already made a number of recommendations which have a bearing on the efficient use of time within the humanities themselves. These recommendations have been offered on other grounds, which the committee believes constitute the best reasons for their acceptance; yet their time-saving value is unquestionably important, and may unconsciously have influenced the committee in their favor.

1. The first recommendation concerns the composition or communication problem. The use of 25% or more of the time of the program in the humanities and social sciences for work that is largely at the high-school level is very difficult to defend. Undoubtedly, serious college-level work in communication can be carried on efficiently in courses in the humanities and social sciences; it can also be carried on efficiently in the scientific and technical program. A number of schools are now doing it this way with apparent success. Students who are unable to express their ideas in understandable fashion must be provided for in some way, either by non-credit remedial work or by continuing clinical assistance. The size of the problem varies in different institutions, and no single solution is applicable everywhere. The committee feels that the important thing is to recognize that the problem of bringing the students up to college level should not entail the giving of college credits, though advanced communication of college caliber can be taught as part of the content courses. The true corollary of this statement is that it *must* be taught in these courses. The committee is not arguing that it should be neglected.

Many schools also require an upper-level course in writing, usually taught by the English department, but sometimes by the technical departments. The reason commonly given for placing such a course in the later years is that by then the students have something to write about, the something generally being technical. The committee believes that where this course does deal

with technical material, where it is in effect a technical writing or a report writing course, it should not be considered as part of the humanistic-social program regardless of whether it is taught by the engineering departments or the English department. This is the kind of follow-up work in communication skills that may be essential, but in the interests of saving time, the committee suggests that such programs be allied closely with the content of some engineering course and incorporated in it.

This does not mean that an upper-level communications course may not have considerable value in both content and method to the humanistic-social sequence. As a matter of fact, it might conceivably furnish the capstone to the program by tying together the technical with the humanistic-social work. A community survey course like the one previously mentioned, and described in more detail in the Appendix, places heavy emphasis on the organization of humanistic-social material for specific purposes, and its effective presentation may call on the student to integrate his scientific and technological knowledge. Projects of this nature may well be an efficient solution to upper-level work in communication.

2. The second recommendation concerns vertical and interdisciplinary integration. When each course must make a new beginning, since the instructor cannot assume that the student has any relevant background for the work, much time must be spent in an elaborate introductory section which, in the planned sequence, can be dispensed with. The fully integrated sequence has an additional advantage in saving time which is not quite so obvious, but is just as real. In separate courses in the several disciplines there is an implicit assumption that subject matter falls naturally into neat blocks of twelve or sixteen weeks, or in multiples thereof. If an instructor has sixteen weeks for a particular body of subject matter, he will take sixteen weeks whether he really needs it or not. If he needs more, he cannot get it. If he needs less, he cannot take it. In an integrated sequence, even without complete reorganization, the essential subject matter may be discussed in seven weeks or seventeen weeks, or whatever number the subject matter makes appropriate. With the group planning which is essential to the integrated sequence and with the super-abundance of content from which to select, there is little danger that the teacher will be permitted to spend more time than his materials justify. Small units of time can thus be saved which will permit more vital subject matter to be included. In composition, too, in those schools where direct instruction in composition is felt to be essential for everyone, the integrated sequence offers a reasonably effective way of saving time. Instruction in the basic skills can be given in intensive form, if necessary, in the first three, six, or nine weeks of the freshman year with whatever follow-up is necessary coming at intervals throughout the total four years.

The committee asks whether there is any reason why such instruction

must always require sixteen or thirty-two weeks? And why is it assumed that it can be completed for all students in this same definite period? The committee suggests that the modular construction of curricula may be an excellent way of promoting inefficiency in the use of time.

3. The third recommendation of the committee concerns adaptation, and this, too, has much to do with time. A considerable part of the work in the humanities and social sciences has to do with interest and attitudes. The engineering student, having set for himself a definite objective, is often impatient with what he may regard as exploratory side trips. The committee holds that an understanding of the different objectives and methods of the humanities and social sciences is an integral part of the training of the professional engineer. Yet our field workers report extreme difficulty on the part of the arts teachers in getting this across, and much time is spent in groping for ways to cope with this problem. One literature department gives as its central objective "making students see what literature is, what it can do for them, what value it has." This, of course, is important, but it can be done most efficiently if the instructor knows where his students are, understands their particular point of view, and directs his teaching to their acknowledged needs and interests. Time will always be required, but the indications are that the time can be used to better effect when the teacher is able to adapt his material to a specific group.

III

In accordance with its charge, the committee thus far has been chiefly concerned with the utilization of time and the improvement of the effectiveness of the humanistic-social program in engineering education. Its arguments have been primarily directed to the people working in these areas. But in any consideration of time, some attention must be paid to the total curricular problem.

This committee has made no study of the use of time in the scientific and technical portions of the engineering curricula. It was outside its province to do so. But it is our firm conviction that what has been said about philosophy, about content, and about method apply as directly to the engineering portions of the curriculum as to the humanistic-social portion. The committee suspects that engineering teachers feel as strongly about the value of their own specialized courses and the traditional treatment of subject matter as do the arts teachers. They may oppose change with the same tenacity and the same emotional intensity. This is why some wag has suggested that reorganizing an academic curriculum is like trying to move a graveyard.

Yet the committee cannot refrain from offering two general suggestions which are in line with its already stated position, though it is aware that these may provoke the same kind of heated disagreement among engineering edu-

cators that the previous sections may evoke from the arts faculties. The recommendations regarding engineering curricular planning are:

1. That engineering educators keep their eyes on the professional training of their students and on preparing them for continuing professional growth, not on their first job. The unrealistic attempt to produce "finished engineers" in four or five years is the principal reason for insisting on the inclusion in the curriculum of many of the highly specialized applied courses of which so many engineers are so fond.
2. That the principles of integration which have been recommended for the humanistic-social stem be also applied more generally to the scientific-technological stem. The relation of the basic sciences, including mathematics, to each other and to the applied sciences should be examined in the same critical spirit the committee has suggested for the humanities and social sciences, and with the same object of increasing the meaning and continuity of the whole program and eliminating unnecessary overlapping and waste of time. This recommendation should be construed neither as an argument against broad training in the basic sciences nor for narrow utilitarianism. The committee recognizes the educational value of the basic sciences. It would like, if anything, the development of a greater breadth of understanding in these fields, but it suspects that this breadth may be achieved, as in the humanities and social sciences, by greater rather than less attention to interrelationships. In the forefront of modern scientific investigation, the discrete nature of the disciplines has been largely lost. Physics, chemistry, mathematics (for example) come together on common ground. Yet the committee found too little reflection of this in the introductory science courses that it observed.

IV

THE question of the five-year curriculum has been raised so many times that the committee feels bound to discuss this possible solution to the time problem, even if only briefly. The obvious theory is that an additional year will provide more time for the broad training of the professional engineer and will solve the time problem for the humanities and social sciences. On both points, the present evidence is inconclusive. Actually, the committee found that the four-year engineering curriculum exists more frequently on paper than in fact. Relatively few engineering schools advertise a five-year program; many more require more than four years, since a majority of their stu-

dents must either make up prerequisites before starting their engineering programs, or must take extra semesters to complete courses failed or coming out of sequence. In one institution the field workers found that only one student in last year's graduating class had actually finished the work in four years.

Many of these institutions are talking about going to five years. Some have already done so. And some others have extended their curricula by entering into various arrangements with liberal arts schools, often on a three-two plan whereby the student takes three years of liberal arts, two of concentrated engineering, and receives degrees from both institutions.

The committee must report that in some of the five-year programs it looked into, the extra time is being used to put in more specialized technical courses rather than more liberal arts courses. And surprisingly enough the same situation obtained in the three-two programs: students preparing in a liberal arts school for ultimate entrance to engineering seem to be so awed at their future prospects that they sometimes take more scientific-technical courses and fewer liberal arts courses in their first three years in the liberal arts school than they would have taken in a similar period in the engineering college itself. The committee feels that neither the five-year program nor the three-two plan will automatically solve the problems of time in engineering education. The basic problem of planning and replanning remains the same.

V

Probably the greatest single practical obstacle to the establishment for all engineering students of a substantial core of study in the humanities and social sciences is the Advanced ROTC program. And this is an obstacle which was not foreseen at the time of the Hammond Report. Nearly all engineering schools today have ROTC programs and our evidence shows that anywhere from 10% to 50% of engineering upperclassmen are enrolled. In a majority of institutions, credit toward graduation, usually 12 semester hours, is allowed for Advanced ROTC. Further, in a majority of institutions, this credit may be substituted for all or a substantial part of the required and elective work in humanistic-social studies. The net effect is that a very high proportion of engineering graduates do not get anything like the amount of study in the humanities and social sciences that the engineering faculties planned and hoped for.

This committee did not undertake an exhaustive study of the ROTC problem since another committee of the Society is doing so. We are, however, gravely concerned about the matter, since it is obvious that the humanistic-social programs are the chief victims of the existing arrangement. It should be noted, however, that the technical programs suffer significantly also and that this is, therefore, a problem of vital interest to all engineering educators.

We hope it is not necessary to say that we believe in the importance, both to the student and to the nation, of the ROTC programs, and we would not, in the present state of the world, wish to see them weakened. The question we raise is about the amount of time and college credit involved, and the relationship of that credit to the humanistic-social program.

First, the essential facts should be made clear. Most land-grant colleges require all able-bodied non-veteran men to take two years of military science and drill, although the land-grant charters compel them only to make such a program available to any students who desire it. The last two years of advanced training, leading to a commission in the Reserves, are optional. Students who take advanced training are paid a small amount and are supplied with uniforms.

There is no uniformity in the matter of granting credit for this work. Practice throughout the country varies from that of granting none at all, to granting as much as 24 semester hours. Where credit is granted, practice ranges from treating it as purely psychological credit (that is, the hours required for graduation are increased by an amount equal to the number of hours of credit granted) to allowing it to be substituted at par value for academic work.

The lack of uniformity in the treatment of ROTC credits is the thing that most struck this committee. Further, we were able to detect no correlation between the credit question and the apparent effectiveness of the military units. In institutions that granted no credit at all, the ROTC units seemed to attract as many students and to have as vigorous and vital a program as those which granted a substantial amount of credit. This latter is an impression rather than a demonstrable fact, but we believe it to be an impression that will be borne out by more careful investigation.

In view of these considerations, we recommend that the Society, through the appropriate committees, move first to establish all the relevant facts; second, to make contact with other educational organizations that may be concerned with the problem; third, in cooperation with representatives of these other organizations, to confer at the national level with the responsible officers of the military services with a view to establishing some kind of uniform policy with regard to the granting of college credit for military courses.

It is the hope of this committee that a policy of granting no credit at all may be established. If, however, it is found that this is not feasible without jeopardizing the efficiency of the ROTC program, the committee feels it would be a considerable gain if practice in the granting of credit could be standardized throughout the country.

One further matter in connection with ROTC needs to be mentioned. Several institutions have begun to substitute ROTC credit for humanistic-social requirements on the ground that the courses offered often closely

parallel courses in the social sciences given by the college faculty. Courses in military history, geography, and leadership training are examples. The committee has examined some of the materials used in these courses, and has found them often of very high quality.

Despite this high quality, we have serious reservations about encouraging this practice. First, the instructors in the military courses are neither permanent nor equally capable of teaching at the college level. Some of them could qualify as members of any college faculty; others could not. Second, the purpose of the military course is to train officers, and classes are seldom conducted in an atmosphere encouraging to the free exchange of ideas, an atmosphere that is indispensable to the attainment of the objectives we have in mind. Finally, the rigid control exercised by military authority over subject matter and examinations is out of the hands of the academic faculty. We doubt the wisdom for any faculty of allowing itself to be maneuvered into a position where it approves degrees earned through taking courses over which it has no effective control.

The committee suggests that as a matter of long-range policy it would be better if the trend were reversed, and the military were asked to substitute, where it is appropriate, academic credit earned in regularly scheduled collegiate courses for some of its requirements. In this way the academic faculty would continue, as it must, to reinforce the important work of the military without involving itself in procedures that might lead to considerable embarrassment.

APPENDICES

Appendix A

Excerpts from the Field Reports

Appendix B

Representative Humanistic-Social Sequences

Appendix C

Courses of Special Interest

Appendix D

Sample Engineering Curricula Incorporating Humanistic-Social Sequences

APPENDIX A

Excerpts from the Field Reports

GENERAL COMMENTS

ONE thing, however, has struck me on my various visits for our project. The colleges seem to welcome the ideas we bring as much as we welcome the ideas we find. X was particularly appreciative. One member of the faculty was later quoted to me as saying: "It was like a cool breeze from the outside." If our small efforts can produce that effect, we have already justified the survey. I hope you will be able to find a place for this point in the final report. It is certainly an argument for improving our system of academic communication.

* * *

But here, as elsewhere, I observed an effect which I think we scarcely contemplated when we began our survey. Our impact upon those we talk with seems greater than their impact on us. I could actually perceive minds beginning to open as we discussed our problems. It seems hard to believe that men might teach undergraduates for years without thinking very much about them, but some ideas which we consider almost platitudes seem to reach many of our interviewees as if they heard them for the first time. Certainly, if we do our work right, no institution can fail to be affected, if only in small ways, by our visits. . . . Whatever the reception of the resulting report, our efforts have not been wasted.

* * *

No steps have yet been taken to provide for a continuation of humanistic-social studies in the first graduate year. This would seem to be desirable, since this selected group of students is the very group most likely to become leaders in society. They are the ones for whom it is most important that they continue to take the broad view of the engineering profession, of society, and of man. In addition to this consideration, however, there is the point that graduate Humanistic-Social work would provide one opportunity for humanistic-social staff members to work with more mature and stimulating minds.

PHILOSOPHY

In talking with staff, it became apparent that more discussion of the objectives of the program with participation of both faculties of Engineering and the relevant teaching departments might result in some changes, both in the program itself and in the individual courses contained in it.

* * *

My impression of the relationship between the School of Engineering at X University and the Liberal Arts Division was that there was much good will but not much intelligence applied to solving the problem of establishing an integration of the humanistic-social stem with the scientific-technological stem. I received the distinct impression that the engineering faculty prescribes so many credits of humanistic-social studies and the liberal arts faculty fills these requirements as a pharmacist fills a prescription. The doctor doesn't consult the pharmacist or vice versa and the patient hasn't the faintest notion of what the medication is or why he is taking it. Stranger still, the doctor doesn't examine the patient or rewrite the prescription either in terms of need or of new pharmaceuticals.

* * *

There is little to say about the history of the scant program in the humanistic-social field for engineers which we found at X. Apparently the Hammond Report had little effect here, but the recent Self-Study Project has begun to show its influence, as previously noted. The spirit of change seems abroad among the engineering faculty, but as much can not be said for the other departments of the College. The apparent reasons for this will be discussed in the Commentary Section, but we may briefly say here that part of the difficulty seems to be lack of mutual understanding, itself due to absence of adequate communication between the engineering faculty and the rest of the College, and even among the engineering departments themselves. There are signs that the general administration of the College is awakening to the problem, but not much yet has been done to improve the situation. But our visit itself may have imparted some impetus; at least that was the impression we gathered in our general conversations, especially with officers of administration.

* * *

This absence of any real plan of liberal study may partly account for what apparently is widespread and strong resistance to the humanistic-social courses that are required. Two or three cooperating departments actually complained of disciplinary problems posed by engineering students in certain courses. In other words, nothing has been done to give these students any

sense of the rationale behind such non-professional work. Maybe this is one of the most important arguments for having an integrated sequence of humanistic-social studies.

* * *

The situation at X is rather easy to describe but very difficult to explain. The facts are that students in engineering are exposed to very few genuinely humanistic or social science courses; that the engineering faculty knows this and is mildly concerned about it; and that only a few men in the arts college care whether engineers receive broader training. The freshman composition courses are skill courses, not humanities. The speech courses are the same, and engineers are segregated in them. There are undoubtedly liberalizing elements in both of these courses, but on the whole they are set up for training rather than for education.

* * *

Both the arts faculty and the engineering faculties thought of the humanities solely in terms of "human relations." The Humanistic-Social stem was considered a useful tool to enable one to "get along with people." This Dale Carnegie version of what constitutes humanistic-social studies means that the program is almost completely devoid of any consideration of philosophical, historical, literary, aesthetic values or content whatsoever, and the Humanistic-Social courses are simply devices by which the student learns a modicum of applied psychology for the handling and treatment of human beings in a factory.

* * *

This engineering college has no clear or even explicit program in the humanities and social sciences. About the only observation that can be made with certainty is that the dean, assistant dean and department heads that we interviewed view the humanities and social studies with suspicion if not distrust. English and speech are accepted for their practical value, as is economics. The course in government would quite probably not be a part of the curriculum if it were not required by state law.

* * *

Because his responsibilities as professional man and as citizen require background and perspective over and above his technical competence, the student of engineering at X devotes about one-fifth of his time to humanistic and social studies. The general aims of these studies are three: understanding of the assumptions of our civilization and their development, capacity for personal satisfaction in literature and in reflective thinking, and competence in the organization and presentation of ideas.

* * *

In practice in the engineering college, each curriculum is heavily loaded with courses in outside but closely related fields, courses which will provide tools for engineers in managerial positions later. This operates to modify the ideal of broadening students and developing them spiritually, into a program of training engineers in additional skills rather than attempting to help them understand their world and become more human in it. Certain social studies lend themselves to this practical purpose, so the "broadening" subjects in the engineering curricula are almost entirely social studies.

* * *

The faculty generally held that the engineers most needed development in reading and thinking about man and his fundamental problems. In the little time available, concentration on the subject matter of the humanities and social sciences (while making use of student's scientific and technological experience in the course of classroom teaching) was deemed the most appropriate approach.

* * *

If engineers continue to place such a naive faith in the significance and effect of "human relations," they will ultimately be disappointed in the humanistic-social offerings. They expect too much of the humanistic-social stem. If they do not get what they over-optimistically expect, they might become so disgusted with the humanistic-social stem that they will throw it out of the curriculum completely at some future date, and engineering education will revert to a pre-Hammond Report status. The humanistic-social courses must guard against promising too much to the engineers and must make them aware of the limitations of the humanities and social sciences in bringing "happiness," "adjustment," or "success" to budding engineers. It would be a frightful disservice to the humanistic-social studies if they are "oversold" to the engineers because the resulting reaction would prevent the humanistic-social studies from accomplishing those things which they are actually capable of doing.

* * *

At X, the faculties seem to feel that human knowledge is too broad and various to be comprehended under one program for general education. Yet they recognize that courses for non-majors cannot be the conventional introductory ones for beginning specialists. Their ideal is to give each student an opportunity to develop some interests outside his own field, and this purpose provides whatever integrating concept exists.

* * *

Among the required courses, economics and psychology are difficult to integrate with history and literature. We observe, in general, that scientific

subjects usually represent a problem in integration. Perhaps greater clarity about the objectives of General Education and their application to engineering students would be of assistance in this connection.

CONTENT

THERE is nothing in a good scientific education that incapacitates a man for citizenship.

* * *

A not negligible number of technical men try on their own to broaden the content of their courses. Perhaps there is even more tendency to do this because of the comparatively weak social science program. Those of us who are interested in an effective over-all program in humanistic-social studies, must guard against breaking down the trend in many of the degree granting departments to present valuable humanistic-social studies information integrated with the technical subjects.

* * *

The program is poorly balanced between the humanities and the social sciences. The only social science is Economics (four hours). No courses in government, political science, sociology, or psychology.

Among the humanities there is no course in history, which is generally regarded as important in non-technical programs for engineers.

Hence there is no balance of any kind. Indeed, our opinion is that though the program may properly be called non-technical, to call it liberal is debatable.

* * *

The second and third criticism would also seem to support the view that one of the abiding dangers of general education is that the wide sweep of generality will become divorced from the patient and systematic examination of concrete fact.

* * *

Wholly apart from the content and level of the psychology course is the question of what is expected of it. The psychologists are trying to teach a complex subject with a specialized vocabulary in the best way they know how. The engineers, however, view psychology as the key to successful human relations, and they tend to look upon it as a sort of college-level Dale Carnegie course, one which will teach the students to be better poker-players than their fellowmen. This bastardized concept of what constitutes psychology and human relations is bound to keep the engineers dissatisfied with

any real offering which attempts to give a psychology course at the college level with real intellectual content.

* * *

It will be noted that X has abandoned the regular freshman composition course. More writing has been incorporated in the first two years to compensate, and it is the feeling of the Humanities group that subject matter and thinking are more important than expression. Others that we interviewed felt that the level of student composition had improved greatly since the work in formal composition was abandoned. It was generally agreed, however, that the X students were superior, though some professors still indicated that they were woefully weak in grammar and spelling when they arrived on campus. All we talked with felt that this was a way in which other schools could benefit by following X's lead. In any technical institution, time is limited for work in the humanities, and it was the consensus that this limited time could not be wasted on a formal review of grammar or on writing themes on "A Day at the Beach." Students once interested in ideas and taught to handle them could be persuaded to be decent in expression.

* * *

The two-year Social Science sequence aims to provide an integration of American history, political science, economics, and sociology. It is taught by instructors from those fields, and the problem approach and case method enable them to use an integrated approach to the topics under discussion. This Social Science integration is not required of engineers at the present time, although it will probably be included among the choices which can be made after the new program is adopted. The professor in charge of the course felt that it would be an excellent course for engineers, although some time would be required to build up the courses and staff to take care of the large number of engineers who might choose to take it.

The chairman of the economics department, however, did not view the Social Science sequence with such enthusiasm. He believed that the student would learn more economics from a one-semester 3-credit hour course in regular economics than he would get from this two-year integrated sequence. Interestingly enough, the chairman of the economics department felt that the economics included in the integrated social science sequence was more highly technical than that in the standard economics course. Yet his criticism was that the integrated course gives only a "smattering" rather than any well-grounded fund of knowledge.

* * *

The integrated courses in literature do not involve faculty members from several disciplines. Rather, the integrative concept is one which involves

a literary approach to non-literary subjects. Thus there is a course which deals with ethical problems in modern literature—how they are treated by the writer and the reader. Then there is a course involving the treatment of social issues at work in American literature, and one which involves the reading of a number of literary masterpieces with particular attention directed to the psychological behavior of the characters. The major emphasis in all these courses seems to be in the ideas, rather than in the form and content of the literature, and to that extent they differ from what many might regard as the traditional literary approach.

The question might arise, not as to whether it is good to teach psychology through the medium of the novel, but whether the English professor knows enough psychology to present a course which has some intellectual validity in the field of psychology. Similarly, is the English professor a qualified sociologist, so that he can give a valid approach to social issues through the medium of the novel? Perhaps the integration is in reverse in these cases; and maybe the psychologist might better give the course which deals with social criticism expressed in literature, and the philosopher give the course involving the treatment of ethical problems in literature. Granted that teaching psychology, philosophy, and sociology through literature is a valid approach to those subjects, the question remains as to whether men trained in these specialties or men trained in English should perform this task. This question does not seem to have been asked by those who present these courses.

* * *

A remarkable degree of integration is achieved with such devices as the concept of comparative cultures, of man struggling against institutions, of historical change, and of continuing problems facing mankind.

* * *

The present procedure is marked by an attempt to integrate by making selective analyses of certain aspects of social activity centered within a *whole* context of human society and culture. No survey is given of the various branches of the social sciences as such. An attempt is made to center attention on developing a holistic understanding of human relations instead of emphasizing descriptive knowledge alone. From this study, it is hoped that the students will learn to use factual information for the activation of critical thinking.

* * *

ARRANGEMENT

THE general pattern at X seems to be thoughtfully worked out and to be generally successful. The four-year required sequence, running through the whole undergraduate curriculum appears to work well. Not much has been

done in integrating this program with the professional work, but this does not appear to be thought necessary. As a matter of fact, the professional faculty seems to feel that the Humanities work should be as different as possible from the technical work; though the obvious high standards of the program are what makes it acceptable.

• • •

As the documentary section will indicate, there has been a constant effort in the Humanities Department at X to present a sequential development so that by the senior year the student has had an educational experience as rewarding in this field, and as searching, as in the scientific-technological stem. There is a considerable leeway in the individual courses for experimentation by the instructor, and the classes we visited show that the students receive the humanities work in the same fresh, experimental way. They enjoy the work and profit considerably from the sequence of courses set before them.

• • •

In those cases where the humanities are introduced in the senior seminar, it is felt that real success is achieved. Engineering students are impressed when an engineer gives a lecture on art or music and shows enthusiasm for the arts. The teachers feel that this is much more effective than bringing in people from the arts to teach their own specialty. Evidence of efficacy can be seen in some real art work (notably sculpture) produced by engineering students under this influence.

• • •

In general, as very successful key courses are evolved, these will probably be required in lieu of some of the present electives. At least one elective will remain (perhaps last term senior year) because of the strong feeling here that the mature student should get a chance to pursue a personal interest and to make an intellectual choice.

• • •

X University appears to have achieved the high goals of the best ideals of engineering education. It turns out educated young men who are trained for engineering, rather than specialists trained in engineering with a limited acquaintaince with arts. X has clearly chosen to teach the spirit, the ideal of the arts, rather than to force on all engineering students regardless of abilities or interests a prefabricated unit of courses labeled humanistic-social.

• • •

Many members of the engineering faculty, and particularly the administrative staff, are truly interested in general education as a means for providing opportunity for students to learn about other important areas of human knowledge and to develop into spiritually conscious individuals who participate in society. They are searching for a way to accomplish this without forcing on a great many students and faculty members a system of values and a selection of fields for study which represent the views of only a few. Whenever a prescribed and limited program is drawn up it must represent a selection according to particular standards, so they face a dilemma.

* * *

Controls over election: Except for ROTC, students have considerable liberty of election. Students are sometimes discouraged from electing courses in the College of Arts and Sciences because upper division students are penalized in lower division courses in the number of credits allowed; engineering students often do not have the prerequisites for upper division liberal arts courses.

* * *

Attempts to integrate the various courses in the humanities program seem to have been few. Apparently the assumption has been made that students will make their own integrations without the faculty helping them by means of studied attempts at integration of course content. Evidences of growing concern about the problem were detected, however. The interest of securing men trained in fields not now represented in the Division is one of the evidences. There is also a logic in the sequence of the required courses. Yet the observer cannot help but feel that integration will come slowly because the tradition of rather specialized courses has been strong and because the tradition of few department meetings precludes the necessary planning.

* * *

The problem of general education for engineers is not essentially different from the problem of general education for any other specialist. However, for a number of reasons it was the College of Engineering on this campus which faced it first. In the first place, the College of Engineering is one of the oldest and the largest of the professional schools. Then too, the crowded curricula made it essential to have particular concern for the optimum utilization of the limited time available. Finally, the importance of years of active interest by the ASEE in this problem is not to be underestimated.

* * *

The engineering student was quite generally regarded as careful and intelligent but overdemanding with respect to precision in the reading and

thinking he performed within the liberal arts program. Apart from difficulties occasioned by his very heavy load in engineering and the subordinate role in which he saw the liberal arts, it was felt that he had trouble working with general ideas and tended to get lost in details. The liberal subject matters interested him but were rather hard for him to "lay his hands on."

* * *

ADMINISTRATION

THIS institution confirms the impression received elsewhere that probably the all-important factor in the success (or even the setting up) of a progressive humanistic-social program is the interest of the key engineering people, especially the Dean of engineering. It seems to be an axiom that if the Dean really wants it, he can get a worth-while program, whether the school is a university or an engineering college. And if he doesn't, nothing much is likely to happen. Also, here as elsewhere, it seems certain that any really live birth is going to involve labor-pains.

* * *

At the present time there is a very friendly, but unproductive, relationship between the engineering and the arts faculties. They do not get together to discuss problems of common interest and might just as well be on separate campuses as far as any interchange of thought upon matters with which this Humanistic-Social Project is concerned. It appeared that the liberal arts people were ready and willing to co-operate in improving the liberal studies program in the school of engineering if and when they are invited to do so, but it does not seem likely that they will take any initiative.

* * *

To sum up: the development and administration of the present program has been handled democratically (by committee action) but under the very strong personal leadership of the Dean. The compromise seems to be working very well here, and should continue to.

* * *

One fact that stands out is that the underlying philosophy of the general education program and the aims of its four courses have not been adequately explained to either the engineering faculty or the student body. Possibly it is necessary to ram through programs of general education for engineers, (many would deny that it is necessary) but once these programs have been set up it would seem to be extremely important to explain them as fully as

possible. If the Engineering School faculty could have been given a larger role in the creation of the general education program, their attitude toward it undoubtedly would be both more hospitable and better informed. But because they feel it was foisted on them, they tend to take a hostile know-nothing stance toward the general education program.

* * *

The faculties of the two schools have little in common and do not discuss their mutual problems. In general the engineering faculty have little regard for the objectives or capabilities of the arts and economics staffs, and deplore their lack of initiative in coming up with suggestions. The staffs in A and B seem afraid of the engineers. They are on the defensive, and are afraid to discuss their portion of the curriculum because they fear that if it is mentioned, it will be cut out. There is not the mutual regard that would make for a healthy situation.

* * *

Notably absent was any over-all planning committee for the college or even such a committee for the engineering departments alone. Departments are virtually sovereign states at X and maintain very little diplomatic intercourse.

* * *

While this may explain why the engineering faculty can make decisions regarding the arts program for engineers without bothering too much about including the arts faculty in its deliberations, we do not consider this desirable. Despite the fact that the committee on the humanistic-social stem claims that it intends to consult the arts people, we feel that this matter so clearly involves the arts faculty that they should be included in the deliberations and have a real voice rather than merely be consulted at intervals. The problem is intimately concerned with the capabilities and content of the humanistic-social courses, and the humanistic-social faculty should not be excluded from the deliberations.

It is doubtful if the engineers possess adequate knowledge of the function and purposes of the humanistic-social courses to be qualified to pass on their values to engineering students. We would also be opposed to the arts faculty by itself deciding what would be best for engineering students. The most desirable course would obviously be to have a joint committee for the discussion of these curriculum changes. The engineering staff may know what is best for an engineer, but the arts people would also know what is best in the humanities and social sciences. We deplore this attempt on the part of the engineering faculty to make decisions regarding the humanistic-social

stem without incorporating the humanistic-social faculty in deliberations of this nature.

* * *

Careful planning by groups larger than departments may be more difficult because of lack of communication between parts of the campus. Thus, some members of the engineering staff feel that a one-semester rather than a two-semester course in economics would be desirable, since students could then elect a semester of another social science. The head of the economics department felt that such a course should be given. Yet neither side was aware of the feelings of the other.

* * *

Quite notable and commendable was the spirit of cooperation and mutual understanding existing among the deans, engineering faculty and liberal arts teachers, as well as in the ranks of the latter themselves. Even where important differences of opinion existed, the personalities of the men involved managed to keep those differences within the bounds of patient amicability.

* * *

Although the engineering staff is solidly behind their humanistic program, they do not necessarily understand it. They believe that separate departments of English and mathematics are essential for engineering students to receive sympathetic treatment and efficient handling in those areas of instruction. The question might well be raised: on a university campus, is the creation of a separate English or humanities department in the College of Engineering the best *permanent* solution of the problem? The staff of the College of Engineering on this university campus would emphatically answer "Yes."

* * *

The lack of joint planning with the School of Engineering seems to me one of the obvious reasons for the "orphan status" of the staffs of the interdepartmental courses. If they themselves were somehow part of the engineering faculty, their status would be better. If they could work with engineering faculty they might be more aware of the particular needs and interests of their students.

* * *

Our impressions were definitely that the humanities were taken seriously at X by students and faculty, that they were planned and taught effectively, that staff morale and ability were outstanding, and that other engineering schools could profit from studying the X program. It was also clear that lack of funds prevented the department from doing many things they would

like to do (more with music and fine arts, for example) and from having a more attractive physical environment in classrooms and offices.

* * *

It is difficult to see how these programs can be as effective in practice as they are on paper, since teaching loads would seem to make almost impossible the kind of work which an interdepartmental course requires. (Sections of 35 appear to be considered normal, and each instructor carries five, two usually interdepartmental, the rest departmental courses.)

* * *

There is a need here for lighter loads, smaller sections. *Our report should emphasize the fact that "integrated" courses demand a great deal of the instructor and of the student.*

Occasioned in part by large classes, the predominance of the lecture system here at X as elsewhere obstructs the development of the student's understanding and judgment.

* * *

The personal meeting of teachers and students—developed frequently in an informal manner at X—represents an important part of educational experience. In this respect, auxiliary tutorial systems (especially advisable for honor students) and extra-curricular programs in the humanities and social sciences might prove to be of great assistance.

* * *

Again it should be emphasized that staff members who teach in the integrated program are *not* severed from their own departments, and they are definitely not penalized from taking on the extra interest. Quite to the contrary, staff members who are teaching in the integrated courses are achieving academic promotions and salary increases much faster than the average for the college.

* * *

There is a need for giving staff members of integrated courses some kind of autonomy. Apparently if integration is to be carried on on more than one level as it is in this institution, staffs on the separate levels must be made independent of each other. (It was interesting to observe that the directors of the separate humanities and social studies sequences reacted to the combined social-humanities sequence in much the same way that the heads of the

conventional departments did to them and their courses.) *Somehow a man's advancement must be tied in with his work in the integrated sequence.*

* * *

TIME

ADMINISTRATIVE backing for the program and active faculty support are further indicated by the high percentage of time devoted to the humanities and social studies. This institution proves that even in a university, it is possible to devote at least one-fifth of the engineering student's time to non-technical work without his technical training suffering unduly. At least the persons interviewed had no feeling that their students were at any disadvantage when they were seeking employment.

* * *

The particular need of students in engineering (and in other professional programs as well) is for compression. Programs are invariably bulging at the seams with content, and an extremely limited amount of time is available for the humanistic-social studies. Since there is insufficient time for separate introductory courses in each of the many fields of interest, it is essential to provide integrated courses embracing many fields and unconfined by the limits of departmentalized subject areas.

* * *

The department of X and the department of Y cooperate rather well with the engineers, but the department of Z sits *in cathedra* even more obstinately than the A department. It offers a special course for engineers, but apparently despises itself for doing so. I spent a half an hour trying to make the chairman see that a man might benefit from a one-year course in Z even if he had no time for more, but he seemed to persist in his opinion that creatures like us and our engineering students—and indeed all who were not Z majors—belong to the lower orders. I have seldom met so sacerdotal an attitude even among physicians.

* * *

Few of the engineering faculty have any observable concern about the general studies phase of the program although there is no antipathy towards it. Members of the engineering departments are seemingly a bit apprehensive that if too much attention is given to the humanities and social studies the technical competence of the student will suffer. Several times the comment was made that "after all the main thing we are supposed to do is prepare this boy for the technical assignments that he will face after graduation."

* * *

The general direction in which the humanistic-social program is aiming, with integrated general studies continuing throughout the four years but concentrated in the more mature years, is excellent. (This is made possible, in part, by the extent to which the engineering work is pushed into the freshman and sophomore years.) The time devoted to humanistic-social studies is still far too small—of the order of 10 percent of the total. An increase in this percentage could be brought about, it would seem, by the same sort of integrating scholarship in the technical courses which the engineers have insisted upon in the humanistic-social area.

Appendix B

Representative Humanistic-Social Sequences

CALIFORNIA INSTITUTE OF TECHNOLOGY

Year	*Term*	*Course Description*	*Units*
I	1,2,3	English: Reading, Writing and Speaking	6
	1,2,3	History of European Civilization	5
II	1,2,3	History of the U. S.	6
	1,2	Economics	6
	3	Human Relations *or* Industrial Organization *or* Business Law	7
III	1,2,3	Introduction to Literature	8
IV	1,2,3	†Public Affairs	2
		Senior Humanities *	9

* Courses chosen by the student from a list including:

Modern Poetry	Modern Drama
Literature of the Bible	American Foreign Relations
Modern Russia	Military History
Modern France	Modern Germany
Political Behavior	Political Parties
The Political Novel	Psychology
Ethics	Logic
Industrial Relations	American Literature
Foreign Area Problems	

3 term courses are required.

† This course is described in detail on page 726.

CARNEGIE INSTITUTE OF TECHNOLOGY

Year	*Term*	*Course Description*	*Semester Hours*
I	Fall	English Composition I	3
		†Historical Development of Western Civilization I	3
	Spring	English Composition II	3
		†Historical Development of Western Civilization II	3
II	Fall	‡Economic Analysis and Contemporary Problems I	3
	Spring	‡Economic Analysis and Contemporary Problems II	3
III	Fall	Psychology of Human Relations	3
	Spring	Introduction to Literature	3
IV	Fall	Electives: normally one in the humanities	3
	Spring	and one in social sciences	3
			30

† This course is described in detail on page 704.
‡ This course is described in detail on page 717.

In his senior year, the student selects a course from each group—one from Group A and one from Group B.

FALL SEMESTER

Group A	*Group B*
Evolution of the Modern Russian State	Problems in Human Relations
Philosophies and Politics I	The Business Enterprise and Government Control
Problems of Philosophy	Economics of Labor
American Social and Intellectual History	Government Finance and Taxation
Modern Drama	Individual and Social Adjustments
American Literature	Social Interactions
Modern Novel	Psychological Foundations of Industrial Behavior
Studies in Poetry I	

SPRING SEMESTER

The Social Background of Art	Economics of Business Finance
The Far East: Contemporary Period	Business Cycles and Economic Stabilization
Modern Germany	Politics and Governmental Process
Philosophies and Politics II	Economics of Money and Banking
History of Science	Individual and Social Adjustments
Comedy in Literature	Psychological Foundations of Industrial Behavior
Classical Literature in Translation	
Studies in Poetry II	
Shakespeare	

CASE INSTITUTE OF TECHNOLOGY

Year	*Term*	*Course Description*	*Semester Hours*
I	Fall	Composition I	3
		†The Background of American Democracy	3
	Spring	Composition II	3
		†The Background of American Democracy	3
II	Fall	‡The Background of Western Civilization I	4
	Spring	‡The Background of Western Civilization II	4
III	Fall	‡The Background of Western Civilization III	4
	Spring	‡The Background of Western Civilization IV	4
IV	Fall	Non-technical elective	3
	Spring	Non-technical elective	3
			34

† This course is described in detail on page 722.
‡ This course is described in detail on page 706.

CITY COLLEGE OF NEW YORK

Year*	Term	Course Description	Semester Hours
I	Fall	English I (composition)	2
		†Social Studies I	3
		Speech I (vocal expression)	1
	Spring	None	
II	Fall	Humanities I	3
		†Social Studies II	3
		Speech II (declamation)	1
	Spring	English II (composition)	2
		Humanities II	3
		†Social Studies III	3
		Speech III (argumentation)	1
III		None	
IV		None	
			22

* Year typically taken; considerable flexibility possible.
† This course is described in detail on page 714.

CLARKSON COLLEGE OF TECHNOLOGY

Year	Term	Course Description	Semester Hours
I	Fall	Communication	3
	Spring	Introduction to Literature	3
II	Fall	†Humanities I	3
	Spring	†Humanities II	3
III	Fall	Speech	2
		Engineering Economy I	3
	Spring	Engineering Economy II	3
		Civilization	3
IV	Fall	Problems of Civilization	3
	Spring	Elective	3
			29

Liberal Studies Electives

American Government
American Literature II
American History Since 1870
Contemporary Fiction
Drama
China and the Far East
U. S. and World Affairs
History of Science I
Psychology
Introduction to Philosophy
Reading Seminar
Russia and Germany in the 20th Century
Sociology and the Family
History of Science II

† This course is described in detail on page 709.

THE COOPER UNION

Year	*Term*	*Course Description*	*Semester Hours*
I	Fall	English I	2
	Spring	English II	2
II	Fall	Public Speaking	2
	Spring	†Civilization I*	3
III	Fall	†Civilization II	2
		Economics I	2
	Spring	†Civilization III	2
		Economics II	2
IV	Fall	†Civilization IV	2
		Elective[1]	2
	Spring	†Civilization V	2
		Elective[1]	2
			25

* Note the five-term sequence in Civilization.

[1] Each senior elects a "humanities elective" each term. The registration for the four electives is roughly equal. The electives offered are:

Contemporary Literature and Art
Economic Geography
Labor-Management Relations
Social Philosophy

† This course is described in detail on page 712.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Year	*Term*	*Course Description*	
I	Fall	†Foundations of Western Civilization	
	Spring	†Foundations of Western Civilization	
II	Fall	Humanities: ‡The U. S.: Men and Issues	Option A
		or	
		§Modern Western Ideas and Values	Option B
	Spring	Humanities: ‡The U. S.: Men and Issues	Option A
		or	
		§Modern Western Ideas and Values	Option B
III & IV	Four semesters of electives, three of which must be in the same field, from:		

History
Modern Languages
Music
Economics
Political Science
Literature
International Relations
Labor Relations
Psychology

Two additional semester subjects may be taken in lieu of science or engineering electives.

† This course is described in detail on page 703.
‡ This course is described in detail on page 724.
§ This course is described in detail on page 725.

MICHIGAN STATE UNIVERSITY

Year	Quarter	Course Description	Quarter Hours
I	1,2,3	Basic 111 (communication skills)	9
	1,2,3	Basic 121 (natural science)	12
II	1,2,3	Basic 231 (social science)	12
III or IV	1,2,3	Basic 241 (humanities) is taken in the junior year by students in the Electrical and Metallurgical Departments; in the senior year by Agricultural, Chemical, Civil, and Mechanical engineers	12
			45

NORTH CAROLINA STATE COLLEGE

Year	Term	Course Description	Semester Hours
I	Fall	Freshman English	3
	Spring	Freshman English	3
		History	3
II	Fall	Economics	3
	Spring	Literature	3
III	Fall	†Contemporary Civilization	3
	Spring	†Contemporary Civilization	3
IV	Fall	‡Contemporary Issues I	3
	Spring	Elective*	3
			27

* Contemporary Issues II
Recent United States History
The American Mind
American Parties and Pressure Groups
Human Relations in Industrial Society
Philosophical Analysis
The Evaluation of Economic Ideas

† This course is described in detail on page 708.
‡ This course is described in detail on page 728.

STANFORD UNIVERSITY

Year*	Course Description	Quarter Units
I	English Composition and Literature	9
II	†History of Western Civilization	12
III	Social sciences—Choice of general-education courses in two of the following fields: psychology, economics, sociology, political science, anthropology, geography	10
IV	Humanities—Choice of general-education courses in two of the three areas (1) the Fne Arts, Music, Drama, (2) Philosophy and Religion, (3) Literature	8
IV	Scientific writing	3
		42

* Year typically taken; considerable flexibility possible.
† This course is described in detail on page 702.

UNIVERSITY OF WASHINGTON

Year	*Course Description*	*Quarter Hours*
II	Report Writing	2
	Techniques of Communication	3
III	Humanities–Social Studies	3
	Humanities–Social Studies	3
	Humanities–Social Studies	3
	General Economics	3
III	Modern Reading	Elective
or	Technical Writing	Elective
IV	Business Law	3
IV	Humanities–Social Studies	2
	Humanities–Social Studies	2
	Humanities–Social Studies	1
	Industrial Relations	3

Total quarter hours for various curricula:

A.E.	Ch.E.	C.E.	E.E.	M.E.	Min.E.	Ceramic E.	Metal.E.
22	20	28	26	27	14	25	16

APPENDIX C

Courses of Special Interest

(The following course descriptions have been written by representatives of the institutions involved.)

Course title: HISTORY OF WESTERN CIVILIZATION

Institution: Stanford University

Details: 12 quarter hours (4 units per quarter, 3 quarters).
This is a required course, generally at the freshman level.
This course is required of all Stanford students.
Prerequisites—None.

Purpose:

As part of the general education program at Stanford, this course provides a historical survey of the background and development of the Western tradition.

Course description:

The course starts with prehistoric man, traces the rise of the early civilizations of the Near and Middle East, and then considers Greco-Roman antiquity, the Middle Ages, and the modern period. Social and cultural developments are given equal attention and in the more recent period (since 1500) scientific and technological progress are considered along with the rest of the social and cultural history. Also the growing contacts of the West with the Far East, Russia, and Africa are given attention.

Texts and other materials used:

Burns, E. M., *Western Civilizations, their History and their Culture.*
In addition there are extensive readings in contemporary sources and in special studies. The text-book reading comprises about one-fifth to one-quarter of the total.

Supplementary comment from the institution offering the course:

In order to achieve more efficient and searching analysis, three of the four meetings each week are given over to discussions in sections of 25 each or less. The fourth hour is given to a lecture to the whole group by a specialist in the subject under consideration, either from the History

Department or some other, e.g., Classics, Philosophy, Chemistry, Religion, etc. The discussion method has proved very successful here, because the sections have been kept small.

Further inquiries about this course may be directed to:
Professor William C. Bark
History Department
Stanford University
Stanford, California

Course title: FOUNDATIONS OF WESTERN CIVILIZATION

Institution: Massachusetts Institute of Technology

Details: 3 semester hours (3 class meetings per week for 15 weeks), 2 semesters required.
Required course at the Freshman level.
Designed for science and engineering students.
Prerequisite—None.

Purpose:

This General Education course, focusing on peak periods in the experience of Western Man, aims to sharpen the student's awareness of what it means to be human, of human aspirations and human possibilities, of challenges and responses, at the same time that it provides rigorous training in reading and writing and a basis for later work in the separate scholarly disciplines.

Course description:

Half of the first semester goes to 5th century Athens, the remainder to the Middle Ages. The second semester is concerned with selected facets of early modernity, the 16th and 17th centuries, starting with problems that are mainly political and moving on to the effects of the rise of science on philosophy and political theory.

Texts and other materials used:

There is no text; indeed the use of secondary materials in general is slight. The required reading is mainly in great books, in full or in large chunks. Included are such titles as: *Antigone, Medea, Hippolytus,* Thucydides' *Peloponnesian War,* Plato's *Gorgias;* selections from Aquinas, Dante's *Divine Comedy,* Joinville's *Memoirs of the Crusades;* More's *Utopia* and Roper's *Life of More,* Machiavelli's *The Prince,* Marlowe's *Dr. Faustus,* a Shakespearian play (*Richard II* or *Lear* or *Othello*), some Montaigne, some Calvin, Bradford's *History of the Plymouth Plantation;* Galileo's *Dialogue of the Two World Systems,* Hobbes' *Leviathan* and Locke's *Second Treatise.* Work in other primary and in

secondary or "background" materials is available at the option of individual instructors.

Supplementary comment from the institution offering the course:

The course is taught in discussion sections supplemented with individual conferences on a regular and continuing basis. Except for the required treatment of the common titles, a stated minimum theme writing load, and the need to prepare students to meet a common final examination, instructors have a great deal of freedom in working out their own syntheses, following special lines of interest, etc. Regular staff meetings enable the practitioners of various disciplines, history, literature, philosophy and the like, to educate one another and open up possibilities of different approaches to materials which are in many cases quite removed from the teachers' various specialties. The teaching staff includes full professors as well as young instructors. The reading lists are scrutinized annually and changes are put through according to a consensus of the full group. The reading and writing approach is supplemented by art shows through which students are taken by their instructors. It is hoped that we shall eventually be able to work in music on a comparable basis. One section of qualified students who have expressed the desire to do so does the reading and carries on as much of the discussion as possible in French.

Further inquiries about this course may be directed to:

Professor E. Neal Hartley
Humanities Department
Massachusetts Institute of Technology
Cambridge 39, Mass.

Course title: HISTORICAL DEVELOPMENT OF WESTERN CIVILIZATION I AND II

Institution: Carnegie Institute of Technology

Details: 3 credit hours each semester.
This is a required course at the freshman level.
The course is designed particularly with engineering students in mind —though by now it is considered by its staff as perhaps equally suitable for other freshmen.

Purpose:

(1) to train the students in the historian's basic ways of correcting the selection and ordering of evidence on human affairs subjects, and in bringing questions or assumptions important to them into meaningful relation to such organized evidence.

(2) to improve and deepen their understanding of central institutions and problems in the 20th century world, through historical analysis under the teachers' guidance.

(3) to stimulate their interest in historical literature for itself, and to train them in perceptive reading and in orderly and clear exposition.

Course description:

Runs from 31 B.C. to present, stressing throughout the process of arriving by historical methods at sound judgments on the particular interpretations. First Semester: Roman Empire, early Christians, Germans, and the story of their interpenetration (8 meetings); rise and development (1000–1300) of economic life, church, feudal government, and culture (8 meetings); Renaissance art and politics; church reforms and economics from Luther to Dutch Republic (9 meetings); government and commerce, including Colbert, *Robinson Crusoe,* and Adam Smith (6 meetings); science, Enlightenment, and revolutionary theory and fact, from Galileo to the Terror (11 meetings).

Second Semester: the combination of Napoleon and reaction with industrial advance and reform theories, climaxing in 1848 and Marx (11 meetings); Darwinism, Bismarck, Socialism, imperialism, and power alliances, critique of nationalism, Shaw's *Major Barbara* (11 meetings); science and art since 1880, including Freud, J. H. Poincaré, Einstein, and the Impressionists (5 meetings); First World War and economic results, Communist Russia and Hitler, New Deal and Socialist Britain, World War II and its resultant problems for colonial areas and U.N. (13 meetings).

Texts and other materials used:

Ferguson and Bruun, *Survey of European Civilization,* selections totaling about 40% of reading assigned. (Students buy this and Heffner; other readings are on library reserve.)

Heffner, *Documentary History of the United States,* seven readings used.

Heaton, *Economic History of Europe,* about 100 pages used.

Source readings, selected, from Tacitus to Col. Nasser.

Interpretative analyses, selected, from Gibbon to Walter Millis. (The latter vary in length from two-hour reading to a page; as far as possible they are in the variety of books that might turn up in an average personal library.)

Supplementary comment from the institution offering the course:

The students are divided into sections of 25–30, and class time is spent discussing the problems raised by each day's assignment. Assignments are shaped with care to give training in the skills needed for homework preparation: starting with simple note-taking and map exercises, they build up through more difficult exercises and study questions toward

the goal of successful independent study. The instructors are individually responsible for adjusting the sequence of assignments, and repetitions of training, to fit the progress each section makes.

The readings, though providing over-all survey coverage, are chosen to focus narrative detail, substantial source reading, and conflicting interpretations, at a limited number of precise historical points. Students are expected, in class and in examinations, to reach their own conclusions, and they are helped in many incidental ways to understand that this training in judgment is directly transferable to life and work after graduation.

Further inquiries about this course may be directed to:

Professor P. L. Ward, Head
Department of History
Carnegie Institute of Technology
Pittsburgh 13, Penna.

Course title: THE BACKGROUND OF WESTERN CIVILIZATION I, II, III, AND IV

Institution: Case Institute of Technology

Details: 4 hours per semester. The course runs through the sophomore and junior years.

Required of all sophomore and junior engineering students.

The course is designed particularly for engineering students.

Prerequisite—required courses of the freshman year:
American Democracy I and II and Composition I and II.

Purpose:

(1) To give the student knowledge and understanding of the culture and society in which he lives by acquainting him with the development of that culture and society from its beginnings to the present time; (2) To provide the student with some understanding of the origins and evolution of modern science and technology and to make him aware of the social and cultural impact of scientific and technological developments, thereby making the student think of his future career in other than purely vocational terms; (3) To acquaint the student with Western philosophic, religious, and social thought so that he may work out a satisfactory personal philosophy; to develop, through discussion and study of art, literature, and music, his aesthetic tastes and critical judgment; to broaden and enrich his life as a human being by exposing him to some of the best of human thought and activity in the heritage of Western Civilization.

Course description:

The course uses a chronological framework, starting with the Greeks and continuing to the present day. Within this framework, an attempt is made to integrate all the aspects of a society—political, economic, social, cultural, scientific and technological—into a meaningful pattern. The course is limited to Western Civilization and, while the entire panorama of Western history is covered, there is no attempt to provide equal coverage for all periods. Emphasis is placed on those historical periods which have the greatest relevance to the present; for example, Greek civilization occupies approximately 12 per cent of the course, Roman civilization only about 6 per cent, while fully half the course is devoted to the period from 1789, including one quarter on the period since 1914. Emphasis is placed on developments in science and technology, the social and cultural milieu from which they issued and their impact upon society. The course is not limited to a political and economic survey; fully half the time is devoted to cultural concerns, including religion, art, philosophy, music, and literature.

Texts and other materials used:

Easton, *The Heritage of the Past*
Brace, *The Making of the Modern World*
Knoles and Snyder, *Readings in Western Civilization*
This is supplemented by numerous outside readings from duplicate copies in the library plus a collection of slides, recordings, reproductions of masterpieces of painting and sculpture and other visual aids.

Supplementary comment from the institution offering the course:

This is not a large lecture course. In order to facilitate discussion, the course is given in small sections not exceeding twenty-five men. The staff are trained in various disciplines: historians, specialists in literature, philosophers. While this results in a variety of emphases, the staff, numbering sixteen, use a common syllabus of required work and common final examinations. Advantage is taken of the diversity of staff by changing instructors each semester.

The student is asked to buy a textbook and book of readings. In addition, over one third of the assignments are made in multiple copies of books on reserve in the Case Institute library. Extensive use is also made of audio-visual aids. During the final semester of the course, the student devotes about one quarter of his time to an individual or group research problem in which emphasis is placed on the methods, sources, and problems of such investigation in the humanities and social sciences. Because of the breadth and unusual emphases of this course, the staff has found existing texts and anthologies inadequate and has undertaken to prepare its own.

Further inquiries about this course may be directed to:
Professor Robert L. Shurter, Director
Division of Humanities and Social Studies
Case Institute of Technology
Cleveland 6, Ohio
or
Professor Frederick L. Taft
Executive Officer
Department of Language and Literature
Case Institute of Technology
Cleveland 6, Ohio

Course title: CONTEMPORARY CIVILIZATION

Institution: North Carolina State College

Details: 3 semester hours each of two semesters; total 6 semester hours.
Required course at junior level.
This course is designed particularly for engineers, but open to others.
Prerequisites—one semester each of European History, Literature, and Economics.

Purpose:
The central purpose is to extend the student's knowledge of the fundamental ideas and forces that continue to shape the modern world, with particular emphasis upon the relationships that exist between science and technology on the one hand, and political, social, philosophic and artistic developments on the other.

Course description:
The medieval world view is examined first as a background to the scientific revolution of the sixteenth and seventeenth centuries; that revolution is studied particularly in the work of Copernicus, Harvey, Galileo, Bacon, Descartes, and Newton. The Enlightenment, the American and French revolutions, and the industrial revolution are dealt with both in contrast to the middle ages and as sources of fundamental ideas and attitudes in contemporary civilization.
The second semester deals with nineteenth and twentieth century thought, paying special attention to new developments in physics, astronomy, and psychology that appear to be changing again man's basic concepts about nature and his relationships to it.

Texts and other materials used:
Readings for Contemporary Civilization (a book of readings specially prepared for this course)
Chaucer, *The Canterbury Tales*

Butterfield, *The Origins of Modern Science*
The Autobiography of Benjamin Franklin
Sullivan, *The Limitations of Science*
Boulding, *The Organizational Revolution*

Supplementary comment from the institution offering the course:

This is an interdisciplinary course designed to show that at the philosophic level all human activities, including science and technology, reflect similar responses to any given set of basic concepts and beliefs. On the practical level, it is hoped that this will help the engineering student understand, first that his professional work is not unrelated to that of others, and second that his own studies, properly understood, provide some bridge to a comprehension of contemporary architecture, music, painting, and literature, as well as ethics and political and social theory.

Further inquiries about this course may be directed to:

Dr. George A. Gullette
Department of Social Studies
North Carolina State College
Raleigh, North Carolina

Course title: HUMANITIES I AND II

Institution: Clarkson College of Technology

Details: 6 semester hours.
This is a required course at the sophomore level.
The course is designed for engineering students.

Purpose:

The purpose of the course is to introduce to the student some highlights of our cultural heritage in literature and the arts, to show how they illuminate human nature, motives, and aspirations, and to give the student some knowledge of the principles, terms, and techniques of the arts. It is hoped the student will develop criteria for sound judgment, and a high sense of human values.

Course description:

The first semester spotlights the literature of Greece, the Bible, and the Renaissance, with an introduction to architecture and sculpture, their problems and techniques. The second semester covers literature from the eighteenth to the twentieth centuries and introduces the student to music and the graphic arts, their techniques and forms. The students write three essays and undertake a creative project in one of the arts. Slides, filmstrips, and films are used along with concurrent exhibitions in the student union. Books listed below give the scope of the course,

but some changes are made each year. To achieve some depth, we spend more time on fewer works.

Text and other materials used:

Homer, *Odyssey* (Rouse translation)
Seven Famous Greek Plays (ML)
Dialogues of Plato (Pocket Book)
The Bible (Rinehart)
Chaucer, *Canterbury Tales* (Coghill trans., Penguin)
Montaigne, *Selections* (Crofts)
Shakespeare, *King Lear* (Kittredge)
Marlowe, *Doctor Faustus* (Crofts)
Milton, *Samson Agonistes and Shorter Poems* (Crofts)
Swift, *Gulliver's Travels*
Rinehart Book of Verse
Arnold, *Four Essays* (Crofts)
Dostoyevsky, *Crime and Punishment*
Shaw, *Arms and the Man*
Steinbeck, *Grapes of Wrath*
Sullivan, *The Limitations of Science* (Mentor)

Supplementary comment from the institution offering the course:

Special features of the course are the combining of literature and the arts, and the creative art project required of the students.

Further inquiries about this course may be directed to:

Professor Donald G. Stillman, Chairman
Department of Liberal Studies
Clarkson College of Technology
Potsdam, New York

Course title: INTRODUCTION TO THE HUMANITIES

Institution: Stevens Institute of Technology

Details: 4 credit hours each semester of the freshman year.
This is a required course at the freshman level.
The course is designed for engineering students.

Purpose:

This course was introduced in 1941 to supplant courses in European History and European Literature formerly given. Although designed particularly for engineering students, since its inception a similar plan has been recommended and adopted for their freshman introductory courses by some of the leading liberal arts colleges as well as by other technical schools.

Course description:

The first term is a study of the foundations of Western Civilization. Instead of trying to present a complete sequence of the development of civilization in the West, we have selected certain specially significant periods and topics in which the patterns of cultural growth can best be observed and analysed in some detail. For five weeks the lectures and reading center on the Periclean Age of Greece–the Fifth Century B.C. Here the characteristics of classical civilization are well illustrated. The next five weeks are concerned with the contrasting structures of medieval Christian society in the 12th and 13th Centuries. The last five weeks of the term deal with the period of the Renaissance where medieval institutions are seen in process of rapid change and the first clear signs of the modern age are apparent. In another sense this period provides a logical conclusion to the term's work, since the Renaissance is in some respects a synthesis of classical and medieval civilization.

The second term of the course deals with the culture of modern Europe. The main emphasis is on the development of modern man and his outlook as shaped by (1) scientific method and the Enlightenment, (2) the great social changes implied in the French and Industrial Revolutions, and (3) Victorian England as an example of the industrial age.

Texts and other materials used:

Reading List–Term I

Herodotus, *Persian Wars* (selections)
Plutarch, *Lycurgus, Solon, Pericles, Alcibiades*
Aeschylus, *Agamemnon*
Sophocles, *Oedipus Rex*
Euripides, *Medea*
Aristophanes, *Lysistrata*
Plato, *Apology of Socrates, Phaedo, Republic* (Books II and III)
Thucydides, *History of the Peloponnesian War* (selections)
Oldenbourg, *The Cornerstone*
Villehardouin, *Memoirs of the Fourth Crusade*
Chaucer, *Canterbury Tales* (selected)
Machiavelli, *The Prince*
Cellini, *Autobiography*
Merejkowski, *Romance of Leonardo Da Vinci*

Reading List–Term II

Shakespeare, *Richard II, Macbeth*
Molière, *Shopkeeper Turned Gentleman*
[illegible]aire, *Candide*
[illegible]*oems* (selections)

Young, A., *Travels in France* (selections)
France, A., *The Gods are Athirst*
Tolstoy, *War and Peace* (abridged edition)
Marx, K., *Communist Manifesto*
Leo XIII, *De Rerum Novarum*
Maurois, A., *Disraeli*
Ibsen, *Ghosts, Enemy of the People*
Conrad, J., *Heart of Darkness*
Galsworthy, J., *Man of Property*

Supplementary comment from the institution offering the course:

Reading assignments in the course run to 150 or more pages a week. As far as practical the readings are in authors contemporary to the period studied, although we have not thought it wise to be too doctrinaire in this matter. Our aim in choosing the readings has been to present a well-rounded picture of many phases of the period studied. We have preferred famous works where they were relevant but we have not bound ourselves to the dogma of Great Books. In general we have tried to find histories with literary value and literature with historical value.

There are three lectures a week shared equally by three members of the Department. Two of them are concerned with the development of ideas and institutions and general historical background. The third traces the literary influences and manifestations. In the fourth hour the class is met in small sections for discussion. A quiz on the current reading is given in those sections weekly. Every five weeks the class writes an "hour paper" in one of the lecture hours on an assigned topic covering the preceding section of study. The final examination consists of two such topics plus an objective test on the material of the lectures of the whole term.

Further inquiries about this course may be directed to:

Professor John P. Fife
Humanities Department
Stevens Institute of Technology
Hoboken, New Jersey

Course title: CULTURAL HISTORY OF WESTERN CIVILIZATION

Institution: The Cooper Union

Details: Five semesters—11 credit hours.

This is a required course at the sophomore, junior and senior level.

The course is designed particularly with engineering students in mind.

Prerequisite—Freshman English.

Purpose:

The dominant objective in these studies is to lay before the student a recognizable pattern of thought and achievement in the past that will go some way toward giving him a sense of the continuity of his civilization, its principal values and forces.

Course description:

Civilization I–the history, literature, fine art, and philosophic thought of ancient Greece and Rome. Civilization II–major ideas of the Middle Ages and the early Renaissance as seen in the social, political, religious, and artistic ideals of the periods. Civilization III–literature, science, philosophy, social beliefs, and revolutionary ideas from the late Renaissance through the Age of Reason. Civilization IV–major cultural concepts of the nineteenth century with special reference to: the French Revolution, the Industrial Revolution, Romanticism, influence of the biological sciences, rise of modern political theories. Civilization V–American cultural history from the American Revolution to 1900. Study is centered upon Alexis de Tocqueville's *Democracy in America* from which explorations are made into the social, political, economic, literary, and philosophic thought of the period.

Arrangement of the materials for study is made so that literature, history, philosophy, religion, social thought, scientific thought, and the fine arts shall be examined so far as possible in concert, these various branches of human thought and action illuminating one another.

Texts and other materials used:

Setton and Winkler, *Great Problems in European Civilization,* Prentice-Hall, Inc.

Anderson and Warnock, *World in Literature,* Volumes I and II. Scott, Foresman & Co.

Pope, *The Poetry of Pope–A Selection,* Appleton-Century-Crofts.

Swift, *Gulliver's Travels,* Rinehart & Co.

Voltaire, *Candide,* The Penguin Classics.

F. Hegel, *Reason in History,* Liberal Arts Press, Inc.

Alexis de Tocqueville, *Democracy in America,* The World's Classics, Oxford University Press.

Richard W. Leopold and Arthur S. Link, *Problems in American History,* Prentice-Hall, Inc.

In addition to the regular readings and class work in the Civilization courses the following special features are scheduled:

Civilization I–slide lectures on Greek and Roman art one hour each week
–tour of the Cooper Union Museum for the Arts of Decoration

Civilization II–lecture-tour of The Cloisters
–lecture-tour of the Arms and Armor Collection of the Metropolitan Museum of Art

Civilization III—lecture at the Frick Collection on 18th Century painting —lecture, with recordings, on Baroque and 18th Century music
Civilization IV—lecture, with recordings, on 19th Century music —showing of the motion-picture "1848"
Considerable use of slides and recordings is made in regular class sessions to demonstrate how the spatial arts and music, as well as literary works, reveal the dominant ideas of an historical period.

Further inquiries about this course may be directed to:
Professor Weller B. Embler
Department of Humanities
The Cooper Union
Cooper Square
New York 3, N. Y.

Course title: Social Studies I—The Rational and Ethical Foundations of Western Civilization
Social Studies II—Contemporary European Civilization, some Major Problems and Issues
Social Studies III—American Civilization

Institution: The City College of New York

Details: Three credit hours per course for a total of 9 semester hours.
This is a required course begun in the freshman year; many students do not complete the sequence until sometime in their junior year.
The sequence was prepared specifically for engineering students.
Prerequisite—The course does not have any prerequisite. Students, however, cannot take the second term of the sequence without having passed the first term; nor can they take the third term without having satisfactorily completed the work of the second term.

Purpose:
The purposes of the sequence are general and specific.
1. *General:* To enable the engineering student to secure a more effective general education in the social science area of the liberal arts curriculum. The three courses making up the sequence are non-specialized, non-vocational, and inter-disciplinary in the organization of subject matter. They are designed to provide a sound basis for (a) continuing personal development (understanding and behavior), and (b) for the successful assumption of the responsibilities of citizenship.

2. *Specific:*
Social Studies I: This course is concerned with developing a critical understanding and appreciation of some of the major values of Western

Civilization, and a knowledge of their historical background. These values are (a) the rational and scientific traditions (the Greek world is studied for this purpose), and (b) the ethical and religious ideas of Western civilization (the Hebraic and Christian historical experience is examined for this purpose).

Social Studies II: is concerned with some of the major, contemporary problems and issues as they are found in their European setting. The objectives of the course are (a) to describe the historical background of these problems and issues, (b) to examine critically the theory and practice of modern democratic and dictatorial political systems (communism and fascism), and also of capitalist and socialist economies, (c) to clarify the value systems that are represented by these different institutional arrangements, and (d) to study critically the problems and issues created by the conflict between modern national states.

Social Studies III: has as its purpose the examination of some of the salient aspects of contemporary American society. The course aims to develop an understanding and critical appreciation of American political and economic institutions and of some of the major ideals and values held by Americans today in their highly organized, and independent, industrial and urban communities.

Course description:

Social Studies I:

I. Science and the Scientific Method.
II. Basic Concepts: Man in Society.
III. Greece: The Quest for Knowledge of Nature and Man.
IV. The Religious and Ethical Traditions of Judaism and Christianity.

Social Studies II:

I. The Historical Development of Modern Germany, Great Britain, and Russia.
II. The Clash of Economic Systems.
III. Power and Social Mobility—Democracy and the Modern Totalitarian Political Systems.
IV. War and Peace in 20th Century Europe.

Social Studies III:

I. American Political Institutions and Traditions.
II. The American Economy Today.
III. The Changing American Character.

Texts and other materials used:

Social Studies I:

DeBurg, W. G., *Legacy of the Ancient World*
Naftalin, A. and others, *An Introduction to Social Science*
Aristotle, *Ethics* (Book 1), *Politics* (Book 1)
The Bible, major parts of the Old and New Testaments

Russell, B., *The Scientific Outlook* (several chapters)
Huxley, J., *Man in the Modern World* (chapter on social science)
Epictetus, *The Enchiridion*
Lucretius, brief selections (mimeographed)
Epicurus, brief selections (mimeographed)

Social Studies II:

Schapiro, J. S., *The World in Crisis*
Halm, G. N., *Economic Systems*
Oxenfeldt, A. R., *Economic Systems in Action*
Chandler, A. R., *The Clash of Political Ideals*
Pares, B., *Russia*
Maynard, J., *Russia in Flux*
Taylor, A. J., *The Course of German History*
Neumann, F., *Behemoth*
Rowse, A. L., *Spirit of English History*
Williams, A., *Socialist Britain*

Social Studies III:

Commager, H. S., *Living Ideas in America*
Galbraith, J., *American Capitalism*
Riesman, D., *The Lonely Crowd*
de Tocqueville, A., *Democracy in America*
Hamilton, A., Madison, J., Jay, J., *The Federalist Papers*

Supplementary comment from the institution offering the course:

The following special features may be noted with respect to:

1. Course content:

(a) The subject matter of all three courses is interdisciplinary in content and organization.

(b) The interdisciplinary character of the sequence has helped to create a more experimental and fresh approach to teaching. Thus, there has been a continuing re-examination of objectives, methods, and attainments over the years, and there have been several major changes in the curriculum as a result.

(c) This sequence has found itself less bound in the selection of subject matter to be taught by the traditional limits of the regular disciplines. The staff has therefore been able to concentrate more heavily on what it considers the most important subjects.

(d) These courses have made it possible to give attention to problems, issues, and values, and to stress more regularly the need for critical thinking about social experience.

2. Administration:

(a) Courses are 'run' by staff members who draw up the syllabi, choose the readings, and prepare common examinations.

(b) Teachers in the sequence are full-time members of social science departments in the Liberal Arts College. These instructors teach part of their program in the Social Studies sequence; the remainder of their teaching is done in their 'home' departments.

(c) The responsibility for administering the Social Studies Sequence is assigned by the School of Technology to the Dean of the College of Liberal Arts. The Dean, in turn, appoints a coordinator who is responsible for the actual administration of the program. This person is a regular member of an academic department (at present he is an associate professor in the History Department) and he offers courses in his own department as well as in the Social Studies Sequence.

(d) The coordinator cooperates with the chairmen of the several social science departments in selecting staff members who are competent and willing to teach in the program.

(e) At present teachers in the following academic departments are represented in the Social Studies staff: Anthropology and Sociology, Economics, Government, Philosophy, and History.

Further inquiries about this course may be directed to:

Professor Oscar Zeichner
Department of History
The City College
139th Street and Convent Avenue
New York 31, N. Y.

Course title: ECONOMIC ANALYSIS AND CONTEMPORARY PROBLEMS I AND II

Institution: Carnegie Institute of Technology

Details: 3 hours (9 units) per semester; course runs two semesters.
This is a required course at the sophomore level.
Prerequisite: Historical Development of Western Civilization I and II.
The course is specially designed for engineering students though it could be used by other students without major change.

Purpose:

The primary objectives of the course are:

(1) to stimulate an awareness of, and a continuing interest in, the broad range of economic problems in modern society. Such problems should be seen in the light of their historical background and as existing in a broad current context extending beyond the traditionally conceived boundaries of formal economics.

(2) to place special emphasis on good methods in thinking about social problems in general and economic problems in particular. This objective involves specific attention to the process of orderly problem solving, including careful attention to the processes of logical consistency and to the bases for belief. In the problem areas the focus is on the question: What, all things considered, should be done about any particular social situation (including, of course, situations where complete information is missing)?

(3) to give the student a firm grasp of the few basic principles and operating concepts which he must have in order to think intelligently about economic problems.

(4) to reemphasize and give the student further experience in applying the methods of historical analysis as they were developed in the course "Historical Development of Western Civilization." This includes the importance of seeing present situations in a proper time perspective; emphasis on the fact that the most important problems lie across economics and other social sciences; and the necessity for careful evaluation of evidence.

(5) to provide a good deal of information on modern socio-economic institutions and processes (such as the business corporation and the influence of pressure groups on legislation) primarily as part of the statement and analysis of major problems throughout the course.

(6) to help train the student in thorough, exact reading and in careful concise written and oral expression.

Course description:

The first section of the course is a short examination of the basic elements in the process of handling decision-choice problems—a brief analysis of the problems of straight thinking on social (public policy) problems.

The course then proceeds to the examination of a variety of socio-economic problems, including the problems of agriculture, monopoly, unemployment and inflation, on which the citizen needs to make public policy choices. In each broad problem, an attempt is made to develop the economic tools needed for the analysis; the situation's historical and institutional background, and an awareness of the broader aspects of the problem which will help students handle it in the light of their own social objectives.

The course will be divided into the following major sections:

1. Introduction (about 3 class sessions)
2. Methodology (about 9 class sessions)
3. The business firm (about 5 class sessions)
4. Competitive market analysis (about 12 class sessions)
5. Non-competitive market structures (about 10 class sessions)
6. Measures of national income (about 5 class sessions)

7. The monetary system (about 6 class sessions)
8. The analysis of macro-economic problems (about 14 class sessions)
9. International trade (about 4 class sessions)
10. Income distribution and labor unions (about 7 class sessions)
11. Comparative economic systems (about 3 class sessions)

Texts and other materials used:

The basic text is G. L. Bach, *Economics* (Prentice-Hall, 1954). This is supplemented by a variety of other materials, especially Beardsley, *Practical Logic,* in the introductory section; by Williamson, *Growth of the American Economy* for historical background at a number of points; and by a substantial number of shorter pieces (mimeographed by permission) as indicated in the syllabus. The basic text is used for the framework and central analytical tools; other materials are primarily in connection with the major problems around which much of the teaching is done.

Supplementary comment from the institution offering the course:

The course is primarily planned and supervised by the Economics Department, but all work is done in close cooperation with the History Department, and the course is staffed by about two-thirds economists and one-third historians.

Further inquiries about this course may be directed to:

Dean Glen U. Cleeton
Division of Humanities and Social Studies
Carnegie Institute of Technology
Pittsburgh 13, Penna.

Course title: SOCIAL-HUMANITIES SEQUENCE

Institution: The City College of New York

Details: First semester–7 hours per week (6 credits)
Second semester–4 hours per week (3 credits)
Third semester–3 hours per week (3 credits)
Fourth semester–3 hours per week (3 credits)
This is a required course at the Freshman and Sophomore level.
The course is offered only to engineering students at present, but it was designed on a much broader basis.
Prerequisite–None, except that each course in the sequence must follow in numercial order.

Purpose:

The social-humanities sequence is a series of courses, interdisciplinary in character, designed to bring the work of the social studies and the

humanities areas together to form a single unit. Certain cultures or periods like 5th Century Athens, 7th Century Palestine (B.C.), Reformation, Humanism and Renaissance, or "America in the Twenties," are intensively studied as a whole. Great books of the past and present, from Plato to Faulkner, are used to help the student understand the background, the spirit, the ideas and values of the period. From the contradictory values of western culture, and the understanding of democracy as a wholeness, the student is helped to derive for himself a system of values which would provide those personal and social satisfactions which the liberal tradition used to call "the good life." By encouraging the student to engage in class discussions and panels on specific recurring problems of mankind, the student is helped to develop thinking habits and reading habits which would enable him to face and meet the issues of today and tomorrow in a rapidly changing world.

Course description:

I. *Foundations of Western Culture:* (a) *Patterns of Culture* and four novels are taken up (*Contemporary Culture unit*); (b) Fifth Century B.C. Athens; (c) 7th Century B.C. Palestine; (d) 1st Century A.D. Palestine.

II. *Modern European Culture:* (a) Humanism; (b) Reformation and Renaissance; (c) The Age of Reason; (d) Industrialism, and Economic theories; (d) Democracy.

III. (a) *American Culture* and problems in American Civilization such as: Amherst pamphlets on *American Revolution, The Signing of the Constitution* and *Andrew Carnegie and the Gospel of Wealth;* (b) Romantic poetry and social poetry; (c) Totalitarianism.

IV. *Cultural Values:* Leading currents in philosophy, psychology, history, sociology are taken up via first-rate works of literature in order to help the student find a philosophy of life for himself by finding his values for living from amid the contradictory values of contemporary western culture.

Texts and other materials used:

I. (a) Benedict, Ruth, *Patterns of Culture*
Fitzgerald, *The Great Gatsby*
Dos Passos, *Big Money*
Huxley, *Brave New World*
Orwell, *1984*

(b) *Agamemnon*
Oedipus Rex
Medea
Thucydides, *Peloponnesian Wars*

Plato, *Crito, Apology, Phaedo, Symposium, Republic,* in part.
Old Testament, Prophets, Job, etc.
New Testament, Gospels, as arranged in *A Bible for the Humanities* by Thirwell and Waldhorn.

II. Brinton, *The Shaping of the Modern Mind*
Tawney, *Religion and the Rise of Capitalism*
Marlowe, *Dr. Faustus*
Othello
Rousseau, Burke
Paine (Minnesota Humanities Pamphlets)
Adam Smith to Karl Marx (Minnesota Humanities readings).

III. Untermeyer, *A Treasure of Living Poetry*
Pares, *Russia*
Commager, *America in Perspective*
Problems in American Civilization, Amherst Series: The American Revolution, Signing the Constitution, The Gospel of Wealth

IV. Turgenev, *Fathers and Sons*
Faulkner, *Intruder in the Dust*
Melville, *Moby Dick*
Otto, *Science and the Moral Life*
The Toynbee Thesis; Human Destiny (Lecomte du Nouy)

Audio-visual materials, film strips, records, TV films are also used.

Supplementary comment from the institution offering the course:

1. The teachers in the course meet every other week to discuss progress and problems and are given the opportunity to suggest improvements which are carried out. This gives the men a feeling that they are engaged in self-education and creative teaching.
2. Audio-Visual Aids are correlated with class room work. This semester the lecture hour in Course I (the 7th hour) heard lectures, most of them given by outsiders, on (a) Integration and Meaningfulness in studying cultures and works of literature; (b) Film *The Roosevelt Story;* (c) The world of Thomas Wolfe; (d) The world of Faulkner; (e) Televised film *The Great Gatsby;* (f) Homeric Culture; (g) Athens and Sparta; (h) 'Omnibus Program' televised and reproduced on film by the courtesy of the Ford Foundation; (i) Antigone; (j) Greek Science; (k) Aristotelian philosophy, etc.
3. The course is dynamic and changing. The total philosophy remains the same but the items are tried and tested and retained only where the books used are effective.
4. The last lecture period in Course I is a *student program* in which six students and one student moderator discuss the pros and cons of

material taken up during the semester. Issues such as "The Greeks have a sounder conception of the Universe than the Hebrews,' 'Democracy's Inevitable Weaknesses are Insurmountable' or 'Culture should seek security, peace and stability instead of adventure, conflict and variety,' are debated in this forum.

5. Students are trained to get up in front of the room to take parts in plays, to represent historic personages, to engage in debate or to deliver a short paper on meaningful sections of the readings.
6. The teachers are encouraged to teach all the courses in the sequence so that the total philosophy and purpose of the sequence as well as the subject matter learned by the student is clearly before him as he enters the room and begins to teach a specific course in the sequence. Correlation is well-achieved.

Further inquiries about this course may be directed to:

Professor Louis F. Sas
Department of Romance Languages
The City College
139th Street and Convent Avenue
New York 31, N. Y.

Course title: THE BACKGROUND OF AMERICAN DEMOCRACY I AND II

Institution: Case Institute of Technology

Details: 3 hours per semester.
Required for Freshman year.
Particularly designed for engineering and science students.

Purpose:

To help create in the student a keen sense of his responsibility as an individual, as an American, and as a member of a free society. To introduce him to the social sciences as part of our sequence of courses in the Humanities and Social Sciences and to promote an understanding of contemporary social, economic, and political problems.

Course description:

As it now stands, this course is composed of three general sections: ten weeks of social psychology, ten weeks of institutional economics, and ten weeks of American government. The first section presents some of the principles and methods of resolving conflicts among individuals and groups in America. The second describes the operation of our economic institutions and the relationship between our economy and our society. The third section is designed to supplement the student's

knowledge of the structure and process of his national government and to clarify the ideas of human behavior upon which our political system is based.

Texts and other materials used:

Berrien, F. K., *Comments and Cases on Human Relations,* Harper and Brothers, 1951.

Baker, T. W., *Our Economic System* (in multilith). Part of a planned text.

Burns, J. M. and Peltason, J. W., *Government by the People,* 2nd ed., Prentice-Hall, 1954.

Cases (in multilith) written by the staff.

Supplementary comment from the institution offering the course:

The parts of the course are held together by a definite focal point, contemporary America, and a procedure of moving from the individual to groups, from the simple to the complex, and from the concrete to abstractions. This process, we think, gives our students the means and techniques for studying and being interested in other cultures, contemporary and past.

Because we believe democracy places a high premium on decision-making by the individual citizen, we give our students, as much as we can, the opportunity to make their own decisions in action-demanding cases, to do their own thinking, and to change their attitudes. This procedure may be an answer to these questions:

1. How can we change hostile attitudes toward the study of man and society?
2. How can we transfer student problem-solving interest from the physical to the human areas?
3. How can we raise questions of individual and social values in an interesting manner?

Further inquiries about this course may be directed to:

Professor Robert L. Shurter, Director
Division of Humanities and Social Studies
Case Institute of Technology
Cleveland 6, Ohio

or

Professor Thomas E. Baker
Executive Officer
Department of Social Studies
Case Institute of Technology
Cleveland 6, Ohio

Course title: THE U. S.: MEN AND ISSUES

Institution: Massachusetts Institute of Technology

Details: 3 semester hours (2 class meetings per week for 15 weeks), 2 semesters required.
This is one of two humanities courses between which all sophomores must choose.
Designed for engineering students.
Prerequisite—the required Freshman Humanities Course.

Purpose:

The underlying purpose of the course is, first, to give the student a deeper understanding of his values and attitudes and his limitations in understanding human and social situations; secondly, to give him an appreciation of the nature of the democratic process; thirdly, to provide him with essential information about the operational values and institutions of the society in which he will live and work; and, finally, to indicate how these values, institutions and his whole way of life grew out of the American experience over time.

Course description:

The course does this by focusing on four major issues in the American experience: the making of the Constitution, the coming of the Civil War, the formulation of economic policy in an industrial democracy (considering first the regulation of the corporation and then the regulation of the over-all economy) and the formulation of foreign policy in a democratic world power (concentrating on the making of policy since 1939).

Texts and other materials used:

There is no text. Where possible the writings of the policy makers and other men involved in the issues are read. Novels and poetry are used to illustrate the ideological and cultural situation in which the policy makers worked and to help make clear the nature of the rationales and justifications of the positions they took on the basic issues.

Further inquiries about this course may be directed to:

Professor Alfred D. Chandler, Jr.
Humanities Department
Massachusetts Institute of Technology
Cambridge 39, Mass.

Course title: MODERN WESTERN IDEAS AND VALUES

Institution: Massachusetts Institute of Technology

Details: 3 semester hours (3 classes per week for 15 weeks), 2 semesters required.

This is one of two humanities courses between which all sophomores must choose.

The course is designed for all Massachusetts Institute of Technology students.

Prerequisite–the Freshman Humanities Course.

Purpose:

To inform the student about his ideological heritage and to *involve* him with it by stimulating him to discover and assess not only the significant intellectual contributions of the recent past but his own values as well.

Course description:

First Semester: Study of representative documents of three historical periods, the Enlightenment, Romanticism and Victorianism. Emphasis is placed on long reading assignments in primary sources. The writings selected cover a wide area of human endeavor including political thought, ethics, epistemology, natural science and belles lettres. The course is built around a required reading list common to all sections and a list of optional readings from which the individual instructor can select according to his own and his students' interests.

Second Semester: The same general approach obtains as for the first semester, and the course is organized around such topics as the Revolt from Victorianism, Twentieth Century Totalitarianism, Bases for Values in the Pluralist West.

Texts and other materials used:

Paper back and other inexpensive editions of famous originals are used as much as possible. A sample list follows for the First Semester:

Paine, *Rights of Man*
Hume, *Enquiry Concerning Human Understanding*
Voltaire, *Candide*
Emerson, *Essays*
Stendhal, *Scarlet and Black*
Darwin, *Origin of Species*
Mill, *On Liberty*

Supplementary comment from the institution offering the course:

Sections are limited to approximately twenty-five students so that the course may properly be built around the discussion method. A major purpose

of the course is to improve the students' writing. Consequently, considerable emphasis is placed on student essays written outside of class. These essays written on significant problems related to course content are the subject for personal conferences between student and instructor.

Further inquiries about this course may be directed to:

Professor Irving H. Bartlett
Humanities Department
Massachusetts Institute of Technology
Cambridge 39, Mass.

Course title: PUBLIC AFFAIRS

Institution: California Institute of Technology

Details: One hour class and one hour outside reading for the full academic year.
Required course for all seniors.
Course is designed for all students
Prerequisite—None

Purpose:

To encourage the students to keep themselves informed about problems at the national and international level and to assist them in their efforts to appreciate the point of view of other sectional or national groups.

Course description:

We discuss in class a variety of selected topics which are of concern to the national government of this country. For example, in this term we have been discussing in class the political and economic structure of Soviet Russia. Next term we shall be looking at such countries as China, Guatemala, Turkey and Great Britain. We also take up from time to time such problems as the question of civil liberties or of natural resources.

Texts and other materials used:

The students read the News of the Week section of the *New York Times*.

Supplementary comment from the institution offering the course:

We attempt to supplement the work of the class by encouraging the students to make use of our very effective Public Affairs Room where there are exhibits on problems of topical concern and extensive materials on national and international affairs.

The instruction in the course is undertaken by various members of the faculty and by visiting lecturers of whom the most important are four men who come to us every year from the American Universities Field Staff.

Further inquiries about this course may be directed to:
Dr. David C. Elliot
Humanities Division
California Institute of Technology
Pasadena 4, California

Course title: CONTEMPORARY PROBLEMS

Institution: University of Cincinnati

Details: 3 credit hours for each seven week term.
Required course for senior engineers.
Designed particularly for engineering students.
Prerequisite—None

Purpose:

Within the last half-century the United States has become involved in two world wars. Neither of these wars began in the United States nor were they started by this country; and yet eventually the United States was drawn into both of these conflicts in defense of its national security. In each of these wars the Americans hoped that when they were over there would be a happier and better world in which all peoples would govern themselves and there would be perpetual peace and universal justice. Yet after each war the American people began, in time, to realize that their hopes had not been realized. But as a result of these wars the American people today, more than ever before, know that whatever happens in any part of the world is a matter of vital concern to them personally; and they also know, more than ever before, that the greatest aid in trying to understand the complex cross-currents of present day world politics is a knowledge of the historical background of these issues and of the men and forces which have created these problems. It is with this thought in mind that this course has been organized. It is designed to awaken in the student an interest in current problems and give him an intelligent understanding of these questions in the light of their historical background.

Course description:

The origins of World War I and of World War II are traced in order to explain the forces which brought on these conflicts; why the problems of peacemaking after each of these wars was so difficult and why no durable peace was obtained; and what have been the most significant political, economic, and social trends in Europe and Asia since the end of World War II and what problems they have created for the United States. While the core of the course traces the trends in Europe and

in Asia in the last half-century, the increasing involvement of the United States in world affairs, inevitably makes the course one in global history.

Texts and other materials used:

Walter C. Langsam, *The World Since 1919* (Seventh Edition, 1954).
New York Times Sunday Edition

Supplementary comment from the institution offering the course:

A special feature of the course is a short quiz every week on assigned material contained in the News of the Week in Review section of the Sunday edition of the *New York Times*. These quizzes are in addition to the regular hour quizzes based on material in the text (Langsam) and the lectures.

Further inquiries about this course may be addressed to:

Professor Reginald C. McGrane
Head, Department of History
University of Cincinnati
Cincinnati 21, Ohio

Course title: CONTEMPORARY ISSUES

Institution: North Carolina State College

Details: 3 semester hours each of two semesters; total 6 semester hours.
This is a required course for the first semester—elective for the second—at the senior level.
The course is particularly designed as a capstone to the humanistic-social sequence for engineers, but is open to others.
Prerequisites—All preceding courses in the humanistic-social sequence.

Purpose:

The purpose is to provide some bridge between the classroom and the world of public affairs, to help the student utilize his total education in the analysis of contemporary problems, and to stimulate a continuing interest in keeping informed about the major issues that confront our society.

Course description:

The large problem of redefining individual freedom in a twentieth century context provides the intellectual framework for the year's study. In general, the first semester centers attention on domestic problems, the second on international affairs. The specific issues dealt with may vary from year to year. Currently, the first semester considers civil liberties, with the Oppenheimer case as a concrete example; private versus public enterprise; and segregation in the schools. The second semester

studies the East-West split in its ideological, political, economic, military and cultural aspects.

Texts and other materials used:

The New York Times, Sunday Edition
Today's Isms, Ebenstein
Selected issues of *Current History*
Documentary materials for each problem
The Grapes of Wrath and similar relevant novels of social purpose.

Supplementary comment from the institution offering the course:

There is one lecture and two section meetings each week. Section size is held below twenty to facilitate discussion. Every effort is made to treat each problem in its total complexity, that is, in its moral, its economic its social, and its practical aspects. Controversial issues are not avoided, but they are dealt with as objectively as possible. The student is encouraged at every turn to think problems through for himself, though much is made of the fact that he cannot do so without a command of the relevant evidence. This is a use of the problems course as a culmination, rather than an introduction to, the study of the humanities and social sciences.

The device of multiple lecturers has been used to good advantage in sharpening the issues involved in any problem. Two, three, and even four staff members may in a given lecture hour present the conflicting arguments surrounding any issue.

Further inquiries about this course may be directed to:

Dr. George A. Gullette
Department of Social Studies
North Carolina State College
Raleigh, North Carolina

Course title: THE USES OF LANGUAGE

Institution: Rensselaer Polytechnic Institute

Details: Three credit hours for 16-week semester (48 class meetings)
Required freshman English course
Designed for all college freshman
Prerequisite—None

Purpose:

The course is an intensive workout, both theoretical and analytical, with language in three of its basic uses: to inform, to "create," and to persuade. The aim is *to extend the student's critical control over language,* both his own and that directed at him.

The course requires the student to both broaden and sharpen his *understanding* of language—of its symbolic nature; of its various uses; of how it performs its different jobs; and of the ways in which the reader must "shift gears" as language changes its function. Second, the student develops some *skill* in differentiating uses, in critically analyzing each, and in writing at least informatively.

Course description:

The first few meetings are on language in general—its nature, its main uses, and its relation to other familiar modes of communication and expression. Some background reading in the theory of language is required, both here and later.

The three sections of the main course follow, each devoted to detailed study of one use of language. About five weeks are spent on *informative* language (in news and other reports, historical and philosophical pieces, and miscellaneous articles and essays); six weeks are given to *"creative"* language (in poems, stories, plays, a novelette); and three weeks go to the ways of persuasive language (in pseudo-reports, editorials, advertisements, and other propaganda).

In each section, two basic problems are emphasized: *how words themselves work,* when put to this purpose; and *how they are organized* into formal structures.

The last few meetings are used for review and for introductory discussion of certain more general problems, such as the different sorts of "meaning" language can have, the value of each, and how each should be judged.

Texts and other materials used:

So far, no really adequate text for the theoretical part of the course exists, though one is in preparation. At present, some chapters in Hayakawa's *Language in Thought and Action* and in Hummel and Huntress's *The Analysis of Propaganda* are somewhat useful. The theory of "creative" language is presented by the instructor. Specimens for critical analysis are drawn from various media—newspapers, magazines, paperbacks, and an anthology of assorted literature. In discussing imaginative literature, use is also made of paintings and recorded music. Considerable writing is required.

Supplementary comment from the institution offering the course:

This experimental course (offered since 1953) is apparently unique in concentrating on *language itself*—its symbolic nature, its relation to nonverbal modes, its various functions, and its shifting strategy and tactics. Thus the emphasis is not on the elements of composition (as in most freshman writing courses) though the course probably improves student

writing; nor on literary elements and types (as in many introductions to literature); nor on forms of verbal activity (the reading, writing, speaking, and listening of most 'communication' courses). Yet neither is the course one in semantics, literary criticism, nor linguistics, though some of the principles of all three are introduced.

Especially important in this course is the constant interrelating of language and such other common symbolic modes as mathematics, graphics, music, and the visual arts.

Further inquiries about this course may be directed to:

Dr. Sterling P. Olmsted, Head
Department of Language and Literature
Rensselaer Polytechnic Institute
Troy, N. Y.

Course title: COMMUNITY SURVEYS

Institution: Columbia University

Details: Lectures, conferences and field trips at Camp Columbia, the summer school of engineering. Three weeks, 8:00 a.m.–10:00 p.m., 5 days weekly, 3 points credit.

Required of electrical, industrial, mechanical, metallurgical and mineral engineering students the summer prior to Junior year.

Particularly designed for engineering students but open to others. Has been of interest to students in geography, town planning, education, anthropology, sociology, government, and economics.

Prerequisite—2 years of college

Purpose:

To give students an opportunity to examine the life of a small industrial community—to provide an understanding of the impact of technology upon the social, political and economic life of a community and to emphasize the civic responsibilities of the professional man.

Course description:

Intensive field study of a typical small or medium-sized industrial community and the preparation of reports on industrial activities, public utility operations and community services. Evening conferences and round-table discussions are held with executives, labor representatives and civic leaders.

Texts and other materials used:

No regular text is available. However, much use is made of State Development Commission reports, annual Town Reports, Federal Census

reports, motion pictures, corporation reports, etc. A reference library of several hundred volumes is maintained at camp.

Supplementary comment from the institution offering the course:

The staff is drawn from University Departments of Economics, Government, Sociology, Geography, etc., as well as Industrial, Electrical and Mechanical Engineering.

The work of the students and staff brings to the community a new awareness of the problems of the community as seen by the disinterested observer.

Further inquiries about this course may be directed to:

Professor W. W. Waite
Executive Officer, Department of Industrial Engineering and Management
School of Engineering
Columbia University, New York 27, N. Y.

Course title: APPLIED EXPERIMENTAL PSYCHOLOGY

Institution: Tufts University

Details: 3 credits per semester for two semesters.
This is an elective course at the intermediate level.
The course is designed with the engineering student in mind. It is however, open to Liberal Arts students also.
Prerequisite—first semester—none
second semester—either the first semester or experimental psychology.

Purpose:

To indicate the limits of human physiological and psychological capacities which demands made by machines on their human operators must not exceed.

Course description:

The first term emphasizes man's receptor and motor capabilities. The second term considers the human factor in relation to equipment design, the working environment, and work methods. In typical man-machine systems the display, control and display-control relationships are studied to determine general principles which may be applied to the design of new equipment.

Texts and other materials used:

Chapanis, Garner and Morgan, *Applied Experimental Psychology.*
Outside readings are taken from introductory psychology and physiology texts and from research reports which have bearing on the various topics.

Further inquiries about this course may be directed to:
Professor Philip B. Sampson
Department of Psychology
Tufts University
Medford 55, Massachusetts

Course title: BIOLOGICAL SCIENCES

Institution: Washington State College

Details: 3 hours per semester.
Elective course–freshman to senior level.
Designed for all students.
Prerequisite–None

Purpose:
A study of the attributes of living things, and the unifying concepts and methods of the biological sciences (Bacteriology, Botany, Zoology and their technologies).

Course description:

I. The Nature of Living Things
   A. The structure of living things
      Survey and classification; organs, tissues, cell theory, protoplasmic theory
   B. The activities of living things
      Synthesis, digestion, respiration, growth, reproduction, irritability and adaptation

II. The Whole Animal: Man
   The embryology, histology, and functioning of the vertebrate organism, using Man as the primary example.
   Includes digestive system, circulatory, respiratory, excretory, nervous and endocrine systems.

III. The Whole Plant: The Apple Tree
   The structure, (sporophyte and gametophyte) of a vascular plant, using the Apple Tree as the primary example. The functions; water relations, mineral nutrition, photosynthesis, translocation and storage, reproduction are studied in detail.

IV. Summary: Living things and the World About Them, through the Ages.

Texts and other materials used:
Weisz, Paul B., *Biology*, McGraw-Hill Book Co., Inc., N. Y., 1954.
Hardin, G. A., *Biology, its Human Implications*, W. H. Freeman & Co., San Francisco, Calif., 1953.

Supplementary comment from the institution offering the course:

Our method of teaching is to present the factual material to the class as a whole in lectures, and through assigned readings, and to attempt to have each student integrate the facts into useful biological concepts through planned questioning periods, in which a maximum of twenty students participate ('Dialogues').

Further inquiries about this course may be directed to:

Associate Dean
Division of Natural Sciences
Washington State College
Pullman, Washington

Appendix D

Sample Engineering Curricula Incorporating Humanistic-Social Sequences

(Note: The purpose of this section is to illustrate how a substantial humanistic-social program can be incorporated into engineering curricula of various types. It is hoped that these examples will prove helpful to engineering educators who want to encourage liberal studies, but do not see how the necessary time for them can be found.)

CASE INSTITUTE OF TECHNOLOGY — CHEMICAL ENGINEERING

First Semester	*Credit Hours*	*Second Semester*	*Credit Hours*
Freshman Year			
Anal. Geometry—Calculus	4	Calculus I	4
Physics I	3	Physics II	3
Chemistry I	4	Chemistry II	4
Composition I	3	*Composition II*	3
Graphics I	2	Graphics II	2
Background of Democracy I	3	*Background of Democracy II*	3
Physical Education	0	Physical Education	0
	19		19
Sophomore Year			
Western Civilization I	4	*Western Civilization II*	4
Calculus II	3	Differential Equations	3
Physics III	3	Physics IV	3
Physics Lab. I	1	Physics Lab. II	1
Statics	3	Mech. of Material	3
Anal. Chem. II	6	Chem. Lit.	2
Physical Education	0	Intro. Ch. Engr.	4
		Physical Education	0
	20		20
Junior Year			
Western Civilization III	4	*Western Civilization IV*	4
Phys. Chem.	4	Phys. Chem. II	3
Org. Chem.	3	Phys. Chem. Lab. I	1
Org. Lab. I	2	Org. Chem. II	3
Unit Op. I	3	Org. Lab. II	1
Equip. Design	4	Ch.E. Proc. I	3
Physical Education	0	Unit Op. II	3
		Unit Op. Lab. I	1
		Physical Education	0
	20		19

Summer: Unit Operations Lab. II (2 weeks) 2 semester hours credit
Inspection trip (1 week) 1 semester hour credit

Senior Year			
*(a) Elective	3	*(a) Elective	3
Elec. Engr.	4	*(b) Elective	3
P. Chem. Lan. II	1	Ch.E. Proj. II	3
Ch. E. Proc. II	3	Instrument	4
Met. Fund.	3	Practice of Ch.E.	3
Ch.E. Proj. I	4	Tech. Elective	3
Thermo.	3		
	21		19

* (a) Non-technical elective offered or approved by the Division of Humanities and Social Studies.

* (b) Open elective.

CLARKSON COLLEGE OF TECHNOLOGY — CHEMICAL ENGINEERING

FRESHMAN YEAR

First Semester	*Credit Hours*	*Second Semester*	*Credit Hours*
General Chemistry	4	General Chemistry	4
English Communications I	3	*English Communications II*	3
Fundamentals of Mathematics	4	Differential Calculus	4
Engineering Drawing	2	Engineering Drawing	2
General Physics	3	General Physics	3
Physical Educ. or Mil. Sci.	2	Physical Educ. or Mil. Sci.	2
	18		18

SOPHOMORE YEAR

Chem. Process Calculations	3	Unit Operations I	3
Analytical Chemistry	2	Quantitative Analysis	2
Mechanics, Statics	3	Strength of Materials	3
Humanities I	3	*Humanities II*	3
Integral Calculus	3	Applied Mathematics	3
General Physics: Elec. & Magnetism	4	General Physics: Sound & Light	4
Physical Educ. or Mil. Sci.	2	Physical Educ. or Mil. Sci.	2
	20		20

JUNIOR YEAR

Unit Operations II	3	Chemical Technology	3
Organic Chemistry I	3	Unit Operations III	3
Organic Lab.	2	Organic Chemistry II	3
Physical Chemistry I	3	Organic Laboratory	2
Physical Laboratory	1	Physical Chemistry II	3
Mechanics, Dynamics	3	Physical Laboratory	1
Applied Mathematics	3	*Liberal Studies Elective*	3
	18		18

SENIOR YEAR

Economics: Engr. Applic.	3	*Economics: Engr. Applic.*	3
Unit Operations Lab. I	2	Unit Operations Lab. II	2
Physical Metallurgy	3	Thermodynamics II	3
Thermodynamics I	3	Thesis	4
Design	3	Electrical Engr.	3
Thesis	1	*Liberal Studies Elective*	3
Electrical Engr.	3		
	18		18

MASSACHUSETTS INSTITUTE OF TECHNOLOGY CHEMICAL ENGINEERING

FRESHMAN YEAR

Credit Hours	*First Term*	Hours	*Second Term*	Hours
4	Chemistry, General	6–5	Chemistry, General	6–5
3	Physics	5–6	Physics	5–6
4	*Western Civilization, Foun.*	3–5	*Western Civilization, Foun.*	3–5
2	Calculus	3–6	Calculus	3–6
3	Military Science	3–0	Military Science	3–6
2	*Elective Subject	0 to 6	*Elective Subject	0 to 6
18		42–48		42–48

SOPHOMORE YEAR

	Qualitative Analysis	7–3	Quantitative Analysis	7–3
3	Physics	5–3	Physics	5–5
2	Chemical Engineering	1–1	Chemical Engineering	4–6
3	Industrial Chemistry	3–4	*Humanities*	3–5
3	*Humanities*	3–5	Differential Equations	3–6
3	Calculus	3–6	Military Science	3–0
4	Military Science	3–0		
2		25–24		25–25
20				

JUNIOR YEAR

	Applied Mechanics I	3–5	Applied Mechanics II	3–5
3	Organic Chemistry I	4–4	Organic Chemistry II	4–4
3	Organic Preparations I	6–0	Qual. Organic Analysis	6–0
3	Physical Chemistry I	4–4	Physical Chemistry II	4–4
3	Physical Chem. Lab. I	2–0	Physical Chem. Lab. II	2–0
2	Chemical Engineering	4–6	Industrial Chemistry	3–6
3	*Humanities*	3–5	*Humanities*	3–5
1				
3		26–24		25–24
18				

SENIOR YEAR

	Electrical Engr., Fund.	4–6	Industrial Chemistry	3–6
	Thesis Reports	3–0	Chemical Engineering	4–6
3	Industrial Chem. Lab.	10–0	Thesis	12
2	or		*Humanities*	3–5
3	Chemical Engr. Lab.	10–0	Elective Subject	8
4	Chemical Engineering	4–6		
3	*Humanities*	3–5		
3	Elective Subject	8		
18		49		47

* Six units required in full academic year, may be taken in either term. Number of class hours varies according to subject, with corresponding adjustment of preparation time.

MICHIGAN STATE UNIVERSITY — CHEMICAL ENGINEERING

Freshman Year

Fall	*Hours*	*Winter*	*Hours*	*Spring*	*Hours*
Comm. Skills	3	*Comm. Skills*	3	*Comm. Skills*	3
Nat. Science	4	Nat. Science	4	Nat. Science	4
College Algebra	5	Analytic Geometry	5	Calculus I	5
General Chemistry	4	General Chemistry	4	Engr. Communications	4
		Elem. of Engineering	0	Physical Education	1
Physical Education	1	Physical Education	1		
Military Science	1	Military Science	1	Military Science	1
	18		18		18

Sophomore Year

Social Science	4	*Social Science*	4	*Social Science*	4
General Chemistry	4	Quantitative Analysis	3	Stoichiometry	4
Calculus II	4	Calculus II	4	Differential Equations	3
Prin. of Physics	4	Prin. of Physics	4	Prin. of Physics	4
Physical Education	1	Physical Education	1	Physical Education	1
Military Science	1	Military Science	1	Military Science	1
	18		17		17

Junior Year

Statics	3	*Economics, Intro.*	3	Strength of Materials	5
Thermodynamics	3	Thermodynamics	3	Organic Chemistry	5
Organic Chemistry	5	Organic Chemistry	5	Physical Chemistry	4
Physical Chemistry	4	Physical Chemistry	4	Unit Operations	3
Technical Writing	3	Unit Operations	3		
	18		18		17

Senior Year

Humanities	4	*Humanities*	4	*Humanities*	4
Design	3	Design	3	Design	4
Thermodynamics	3	Unit Operations	5	Instrumentation	3
Unit Operations	5	Accounting	3	Materials	3
Nuclear Physics	3	Electric Circuits	3	Electric Machinery	3
	18		18		17

CASE INSTITUTE OF TECHNOLOGY — CIVIL ENGINEERING

FRESHMAN YEAR

First Semester	*Credit Hours*	*Second Semester*	*Credit Hours*
Anal. Geometry—Calculus	4	Calculus I	4
Physics I	3	Physics II	3
Chemistry I	4	Chemistry II	4
Composition I	3	Composition II	3
Graphics I	2	Graphics II	2
Background of Democracy I	3	*Background of Democracy II*	3
Physical Education	0	Physical Education	0
	19		19

SOPHOMORE YEAR

Western Civilization I	4	*Western Civilization II*	4
Calculus II	3	Differential Equations	3
Physics III	3	Physics IV	3
Physics Lab. I	1	Physics Lab. II	1
Statics	3	Mech. of Materials	3
Graphic Statics	1	Material Testing	1
Elements of Civil Engr.	4	Construction	5
Physical Education	0	Physical Education	0
	19		20

JUNIOR YEAR

Western Civilization III	4	*Western Civilization IV*	4
Dynamics	3	Engr. Geology	3
Simple Structures	5	Fluid Mechanics	4
Highway Engr.	4	Steel Struct.	4
Fund. of M.E.	3	Fund. of E.E.	3
Physical Education	0	Physical Education	0
	19		18

Summer School: Inspection trip, 1 week, 1 hour credit

SENIOR YEAR

**Elective (a)*	3	**Elective (a)*	3
*Elective (b)	4	*Elective (b)	3
*Elective (c)	3	Reinforced Concrete	4
Hyperstatic Struct.	4	Prac. of C.E.	3
Sanitary Engr.	4	Soil Mech.	4
		Hydraulic Engr.	4
	18		21

* (a) Non-technical elective offered or approved by the Division of Humanities and Social Studies.

* (b) Open Elective.

* (c) Elective to be chosen from those offered by the Department of Civil Engineering and Engineering Mechanics.

CLARKSON COLLEGE OF TECHNOLOGY — CIVIL ENGINEERING

Freshman Year

First Semester	*Credit Hours*	*Second Semester*	*Credit Hours*
General Chemistry	4	General Chemistry	4
English Communications I	3	*English Communications II*	3
Fundamentals of Mathematics	4	Differential Calculus	4
Engineering Drawing	2	Engineering Drawing	2
General Physics	3	General Physics	3
Physical Educ. or Mil. Science	2	Physical Educ. or Mil. Science	2
	18		18

Summer Term of five weeks following Freshman year

Elementary Surveying	2
Topographic Surveying	3
	5

Sophomore Year

Mechanics, Statics	3	Mechanics of Materials	3
Oral Communications	3	Engineering Geology	3
Humanities I	3	*Humanities II*	3
Integral Calculus	3	Applied Mathematics	3
Engineering Materials	2	General Physics: Light & Sound	4
General Physics: Electricity & Magnetism	4	Physical Educ. or Mil. Science	2
Physical Educ. or Mil. Science	2		
	20		18

Junior Year

Economics: Engr. Applications	3	*Economics: Engr. Applications*	3
Mechanics, Dynamics	3	Fluid Mechanics	3
Route Surveying	3	Soil Mechanics	3
Electrical Engineering	3	Structural Theory I	2
Applied Mathematics	3	Electrical Engineering	3
Heat Engines	3	*Modern Civilization I*	3
Materials Laboratory	1	Fluid Laboratory	1
	19		18

Senior Year

Advanced Mechanics of Materials	2	Foundations	2
Structural Theory II	3	Structural Theory III	3
Reinforced Concrete I	3	Reinforced Concrete II	3
Concrete Testing Laboratory	1	Structural Design	4
Sanitary Engineering	4	Construction Engineering or M.S.	3
Highway Engineering	3	Machine Design	3
Modern Civilization II	3		
	19		18

MASSACHUSETTS INSTITUTE OF TECHNOLOGY — CIVIL ENGINEERING

Freshman Year

First Semester	*Hours*	*Second Semester*	*Hours*
Chemistry, General	6–5	Chemistry, General	6–5
Physics	5–6	Physics	5–6
Western Civilization, Foun.	3–5	*Western Civilization, Foun.*	3–5
Calculus	3–6	Calculus	3–6
Military Science	3–6	Military Science	3–6
*Elective Subject	0 to 6	*Elective Subject	0 to 6
	42–48		42–48

Sophomore Year

Surveying I	8–0	Surveying II	8–0
Civil Engr. Projects I	6–4	Statics & Dynamics	3–5
Physics	5–5	Civil Engr. Projects II	4–2
Humanities	3–5	Physics	5–5
Calculus	3–6	*Humanities*	3–5
Military Science	3–0	Diff. Equations	3–6
		Military Science	3–0
	28–20		29–23

Junior Year

Materials & Mechanics	6–6	Soil Mech. & Foun. Engr.	6–6
Fluid Mechanics	2–4	Materials & Mechanics	6–6
Engineering Construction	5–4	Structural Engr., Elem.	6–2
Electrical Engr., Fund.	4–6	Fluid Mechanics	3–6
Engineering Geology	4–2	*Humanities*	3–5
Humanities	3–5		
	24–27		24–25

Senior Year

Structural Design	6–0	Reinforced Concrete Design	6–0
Structural Analysis	3–6	Heat Engineering	4–5
Thesis	2	Thesis	7
Humanities	3–5	*Humanities*	3–5
Elective Subjects	24	Elective Subjects	18
	49		48

* Six units required in full academic year, may be taken in either term. Number of class hours varies according to subject, with corresponding adjustment of preparation time.

MICHIGAN STATE UNIVERSITY — CIVIL ENGINEERING

FRESHMAN YEAR

Fall	*Hours*	*Winter*	*Hours*	*Spring*	*Hours*
Comm. Skills	3	*Comm. Skills*	3	*Comm. Skills*	3
Nat. Science	4	Nat. Science	4	Nat. Science	4
College Algebra	5	Analytical Geometry	5	Calculus I	5
General Chemistry	4	General Chemistry	4	Engr. Communications	4
Physical Education	1	Elem. of Engineering	0	Physical Education	1
Mil. Science	1	Mil. Science	1	Mil. Science	1
		Physical Education	1		
	18		18		18

Summer Camp—9 weeks—Engineering Surveying—13 hours

SOPHOMORE YEAR

Social Science	4	*Social Science*	4	*Social Science*	4
Mfg. Processes	3	Structural Drafting	3	Engr. Geology	3
Calculus II	4	Calculus III	4	Strength of Materials	6
Physics Principles	4	Statics	5	Physics Principles	4
Physical Education	1	Physical Education	1	Physical Education	1
Mil. Science	1	Mil. Science	1	Mil. Science	1
	17		18		19

JUNIOR YEAR

Dynamics	4	Struc. Design	4	Reinf. Concrete	5
Struc. Analysis	6	Hydraulics	5	Transp. Engr. II	4
Physics Principles	4	Transp. Engr. I	3	Cons. Prac. & Ad.	3
Electric Circuits	3	Engr. Soil Mechanics	4	Contr. & Engr. Relations	3
		DC & AC Machinery	3	Thermodynamics	3
	17		19		18

SENIOR YEAR

Humanities	4	*Humanities*	4	*Humanities*	4
Stat. Ind. Struc.	4	Water Supply	5	Sew. & Sew. Treatment	4
Hydrology	3	Soil Mech. & Found.	4	Air & High. Pav. Design	4
Seminar	1	Elective	4	Elective	4
Elective	4				
	16		17		16

CASE INSTITUTE OF TECHNOLOGY — ELECTRICAL ENGINEERING

Freshman Year

First Semester	*Credit Hours*	*Second Semester*	*Credit Hours*
Anal. Geometry–Calculus	4	Calculus I	4
Physics I	3	Physics II	3
Chemistry I	4	Chemistry II	4
Composition I	3	*Composition II*	3
Graphics I	2	Graphics II	2
Background of Democracy I	3	*Background of Democracy II*	3
Physical Education	0	Physical Education	0
	19		19

Sophomore Year

Western Civilization I	4	*Western Civilization II*	4
Calculus II	3	Differential Equations	3
Physics III	3	Physics IV	3
Physics Lab. I	1	Physics Lab. II	1
Graphic Statics	4	Mech. of Material	3
Elements of E.E.	4	Material Testing	1
Physical Education	0	Alternating Currents	5
		Physical Education	0
	19		20

Junior Year

Western Civilization III	4	*Western Civilization IV*	4
Circuit Anal.	3	Dynamics	3
Mach. I	4	Networks	4
Electronics	4	Mach. II	4
Illum. Engr.	4	Thermo.	4
Physical Education	0	Physical Education	0
	19		19

Summer: An inspection trip may be elected (1 week) 1 semester credit hour

Senior Year

**Elective (a)*	3	**Elective (a)*	3
Communications	4	*Elective (b)	3
Trans. & Dist.	4	Elect. Measurement	4
Indus. Appl.	4	Industrial Electronics	4
Tech. Elective	3	Tech. Elective	4
	18		18

* (a) Non-technical elective offered or approved by the Division of Humanities and Social Studies.

* (b) Open elective.

CLARKSON INSTITUTE OF TECHNOLOGY — ELECTRICAL ENGINEERING

Freshman Year

First Semester	*Credit Hours*	*Second Semester*	*Credit Hours*
General Chemistry	4	General Chemistry	4
English Communications I	3	*English Communications II*	3
Fundamentals of Mathematics	4	Differential Calculus	4
Engineering Drawing	2	Engineering Drawing	2
General Physics	3	General Physics	3
Physical Educ. or Mil. Science	2	Physical Educ. or Mil. Science	2
	18		18

Sophomore Year

Mechanics, Statics	3	Strength of Materials	3
Integral Calculus	3	Applied Mathematics	3
Humanities I	3	*Humanities II*	3
General Physics: Elec. & Magnetism	4	General Physics: Sound & Light	4
Intro. of Elec. Engr.	4	Electric Circuits	4
Physical Educ. or Mil. Science	2	Physical Educ. or Mil. Science	2
	19		19

Junior Year

Mechanics, Dynamics	3	*Econ: Engr. Applications II*	3
Applied Mathematics	3	Fluid Mechanics	3
Econ.: Engr. Applications I	3	Electromagnetic Circuits & Transformers	3
Oral English	2	Field Theory	2
Principles of Electronics	3	Electronic Circuits	3
Steady-State Theory of Linear Circuits	3	Elec. Engr. Laboratory	2
Elec. Engr. Lab.	2	*Modern Civilization I*	3
	19		19

Senior Year

Electric Transients	3	Rotating Elec. Machines II	3
Rotating Elec. Machines I	3	Electrical Control Systems	3
Transmission Lines	3	Elec. Engr. Laboratory	3
Elec. Engr. Laboratory	3	Heat Transfer in Elec. Engr.	3
Modern Civilization II	3	*Liberal Studies Elective*	3
Technical Elective	3	Technical Studies Elective	3
	18		18

MASSACHUSETTS INSTITUTE OF TECHNOLOGY ELECTRICAL ENGINEERING

Credit Hours	*First Term*	*Hours*	*Second Term*	*Hours*
	FRESHMAN YEAR			
4	Chemistry, General	6–5	Chemistry, General	6–5
3	Physics	5–6	Physics	5–6
4	*Western Civilization, Foun.*	3–5	*Western Civilization, Foun.*	3–5
2	Calculus	3–6	Calculus	3–6
3	Military Science	3–0	Military Science	3–6
2	*Elective Subject	0 to 6	*Elective Subject	0 to 6
18		42–48		42–48
	SOPHOMORE YEAR			
3	Applied Mechanics I	3–5	Applied Mechanics II	3–5
3	Circuit Theory, Int.	7–5	Circuit Theory, Int.	7–5
3	Physics	5–5	Physics	5–5
4	*Humanities*	3–5	*Humanities*	3–5
4	Calculus	3–6	Differential Equations	3–6
2	Military Science	3–0	Military Science	3–0
19		24–26		24–26
	JUNIOR YEAR			
3	Electronic Circuits	7–5	Elec. Energy Convertors	7–5
3	Fields, Materials & Comp.	7–5	Applied Electronics	7–5
3	Adv. Calculus for Engr.	3–6	*Humanities*	3–5
3	*Humanities*	3–5	**Elective Subjects	18
2	*Elective Subjects	9		
3		50		50
2	*Heat Engineering		**Dynamics	
3	*Atomic & Nuclear Physics I		**Heat Engineering	
19			**Atomic & Nuclear Physics II	
			**Adv. Calculus for Engr.	
	SENIOR YEAR			
3	Elec. Power Modulators	7–5	Thesis	7
3	Energy Trans. & Rad.	6–5	*Humanities*	3–5
3	Thesis	2	Elective subjects or	
3	*Humanities*	3–5	additional thesis	30
3	Elective Subjects	12		
18		45		45

* Six units required in full academic year, may be taken in either term. Number of class hours varies according to subject, with corresponding adjustment of preparation time.

MICHIGAN STATE UNIVERSITY — ELECTRICAL ENGINEERING

Fall	*Hours*	*Winter*	*Hours*	*Spring*	*Hours*
Freshman Year					
Comm. Skills	3	*Comm. Skills*	3	*Comm. Skills*	3
Nat. Science	4	Nat. Science	4	Nat. Science	4
College Algebra	5	Analytic Geometry	5	Calculus I	5
General Chemistry	4	General Chemistry	4	Engr. Communications	4
		Elem. of Engineering	0		
Physical Education	1	Physical Education	1	Physical Education	1
Military Science	1	Military Science	1	Military Science	1
	18		18		18
Sophomore Year					
Social Science	4	*Social Science*	4	*Social Science*	4
Economics, Intro.	3	Statics	3	Differential Equations	3
Calculus II	4	Calculus III	4	Prin. of Physics	4
Prin. of Physics	4	Res. Networks I	4	Res. Networks II	4
Physical Education	1	Physical Education	1	E.E. Laboratory	1
Military Science	1	Military Science	1	Physical Education	1
				Military Science	1
	17		17		18
Junior Year					
Humanities	4	*Humanities*	4	*Humanities*	4
One-Circuit Networks	4	Multi-Circuit Networks	5	Multi-Ciricuit Net. II	3
E.E. Laboratory	1	E.E. Laboratory	1	E.E. Laboratory	1
Elec. & Magnetic Fields	4	Elec. & Magnetic Fields	3	Electronic Fundamentals	3
Advanced Math.	3	Advanced Math.	3	Advanced Math.	3
Dynamics	3	Nuclear Physics	3	Thermodynamics	3
	19		19		17
Senior Year					
Networks	3	Networks	3	Non-Linear Networks	3
Electronics	3	Electronics	3	Electronics	3
Lines	3	Electromagnetic Fields	3	Electromagnetic Fields	3
Ferro-magnetic Net.	3	Dynamic Networks	3	Servomechanisms Control	3
E.E. Laboratory	2	E.E. Laboratory	2	E.E. Laboratory	2
Elective	3	Elective	3	Elective	3
	17		17		17

CASE INSTITUTE OF TECHNOLOGY — MECHANICAL ENGINEERING

FRESHMAN YEAR

First Semester	*Credit Hours*	*Second Semester*	*Credit Hours*
Anal. Geometry–Calculus	4	Calculus I	4
Physics I	3	Physics II	3
Chemistry I	4	Chemistry II	4
Composition I	3	*Composition II*	3
Graphics I	2	Graphics II	2
Background of Democracy I	3	*Background of Democracy II*	3
Physical Education	0	Physical Education	0
	19		19

SOPHOMORE YEAR

Western Civilization I	4	*Western Civilization II*	4
Calculus II	3	Diff. Equations	3
Physics III	3	Physics IV	3
Physics Lab. I	1	Physics Lab. II	1
Graphic Statics	4	Mech. of Material	3
Mech. Proc. I	2	Material Testing	1
Mechanisms	3	Mech. Proc. II	2
Physical Education	0	Elements of M.E.	2
		Physical Education	0
	20		19

Summer: Practice Term (2 weeks) or co-op employment, 2 semester hours credit

JUNIOR YEAR

Western Civilization III	4	*Western Civilization IV*	4
Dynamics	3	DC–AC Circ. & Mach.	4
Fluid Mechanics	4	Prod. Engr. II or	
Energy Engr. I	3	*Intro. to Aeronautics	2
Energy Engr. Lab. I	2	Energy Engr. II	4
Prod. Engr.	3	Energy Engr. II Lab.	2
Physical Education	0	Machine Design	5
		Physical Education	0
	19		21

Summer: Inspection trip (1 week) 1 semester hour credit

SENIOR YEAR

***Elective (a)*	3	***Elective (a)*	3
**Elective (b)	4	**Elective (b)	4
Elect. & App.	4	Appl. of E.E.	2
Energy Engr. III	3	Practice of M.E.	3
Energy Engr. III Lab.	1	Metals & Alloys	4
Tech. Elective	4	Tech. Elective	4
	19		20

* To be taken by students electing the Aeronautics Option.

** (a) Non-technical elective offered or approved by the Division of Humanities and Social Studies.

** (b) Open elective.

CLARKSON COLLEGE OF TECHNOLOGY — MECHANICAL ENGINEERING

Freshman Year

First Semester	*Credit Hours*	*Second Semester*	*Credit Hours*
General Chemistry	4	General Chemistry	4
English Communications I	3	*English Communications II*	3
Fundamentals of Mathematics	4	Differential Calculus	4
Engineering Drawing	2	Engineering Drawing	2
General Physics	3	General Physics	3
Physical Educ. or Mil. Sci.	2	Physical Educ. or Mil. Sci.	2
	18		18

Sophomore Year

Mechanics, Statics	3	Strength of Materials	3
Humanities I	3	Mechanisms	3
Intergral Calculus	3	*Humanities II*	3
Metallurgy or Metallography	2	Applied Mathematics	3
Engr. Materials & Mfg.	2	Engr. Materials & Mfg.	2
Gen. Physics: Elec. & Mag.	4	Gen. Physics: Sound & Light	4
Physical Educ. or Mil. Sci.	2	Physical Educ. or Mil. Sci.	2
	19		20

Junior Year

Mechanics, Dynamics	3	*Econ.: Engr. Applications*	3
Applied Mathematics	3	*Oral English*	2
Econ.: Engr. Applications	3	*Modern Civilization I*	3
Thermodynamics	3	Thermodynamics	4
Mechanics of Machines	3	Machine Design	3
Materials Lab.	1	Fluid Mechanics	3
Engr. Mat. & Mfg.	2	Fluid Mechanics Lab.	1
	18		19

Senior Year

Elec. Engr.	3	Elec. Engr.	3
Modern Civilization II	3	*Liberal Studies Elective*	3
Applied Thermo.	4	Applied Thermo.	4
Machine Design	3	M.E. Lab.	2
M.E. Lab.	2	Technical Electives	6
Technical Electives	3		
	18		18

MASSACHUSETTS INSTITUTE OF TECHNOLOGY MECHANICAL ENGINEERING

Freshman Year

First Term	*Hours*	*Second Term*	*Hours*
Chemistry, General	6–5	Chemistry, General	6–5
Physics	5–6	Physics	5–6
Western Civilization, Foun.	3–5	*Western Civilization, Foun.*	3–5
Calculus	3–6	Calculus	3–6
Military Science	3–0	Military Science	3–6
*Elective Subject	0 to 6	*Elective Subject	0 to 6
	42–48		42–48

Sophomore Year

Applied Mechanics I	3–5	Applied Mechanics II	3–5
Machine Drawing	6–0	Engineering Metals	6–4
Machine Tools, Int.	4–1	Physics	5–5
Physics	5–5	*Humanities*	3–5
Humanities	3–5	Diff. Equations	3–6
Calculus	3–6	Military Science	3–0
Military Science	3–0		
	27–22		23–25

Junior Year

Applied Mechanics III	4–8	Fluid Mechanics	4–8
Heat Engineering	4–8	Mech. Behavior of Materials	4–4
Machine Design	4–2	Heat Engineering	3–6
Elec. Engr. Fund.	4–6	Machine Design	5–4
Humanities	3–5	Machine Tool Fund.	3–2
		Humanities	3–5
	19–29		22–29

Senior Year–Power Option**

Fluid Mechanics	3–6	Mech. Engr. Problems	3–6
Heat Engineering	3–6	Power Plant Engr.	6–6
Engineering Laboratory	4–4	Thesis	9
Humanities	3–5	*Humanities*	3–5
Additional subjects	17	Additional subject	8
	51		46

* Six units required in full academic year, may be taken in either term. Number of class hours varies according to subject, with corresponding adjustment of preparation time.

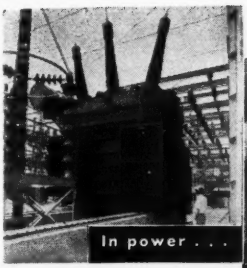
** Similar options of Aircraft Propulsion, Air Conditioning and Refrigeration, Internal Combustion Engines, Materials and Materials Processing, Design, Production, Textiles, and Nuclear Engineering.

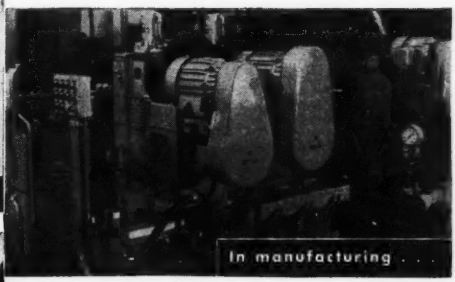
MICHIGAN STATE UNIVERSITY — MECHANICAL ENGINEERING

Fall	Hours	Winter	Hours	Spring	Hours
Freshman Year					
Comm. Skills	3	*Comm. Skills*	3	*Comm. Skills*	3
Nat. Science	4	Nat. Science	4	Nat. Science	4
College Algebra	5	Analytic Geometry	5	Calculus I	5
General Chemistry	4	General Chemistry	4	Engr. Communications	4
		Elem. of Engineering	0		
Physical Education	1	Physical Education	1	Physical Education	1
Mil. Science	1	Mil. Science	1	Mil. Science	1
	18		18		18
Sophomore Year					
Social Science	4	*Social Science*	4	*Social Science*	4
Calculus II	4	Calculus III	4	Statistics Methods	3
Mach. Dr.	3	Statics	5	Strength of Materials	6
Metals & Alloys	4	Mfg. Processes	3	Proc. Analysis	4
Physical Education	1	Physical Education	1	Physical Education	1
Mil. Science	1	Mil. Science	1	Mil. Science	1
	17		18		19
Junior Year					
Dynamics	4	Theory of Mach. I	4	Theory of Mach. II	4
Thermodynamics I	5	Thermodynamics II	4	Thermodynamics III	4
Circuit Fundamentals	5	Electronics Fundament.	4	Fluid Mechanics	3
Engr. Analysis I	3	Engr. Analysis II	3	Prod. Engr. I	4
		Prin. of Physics	4	Nuclear Physics	3
	17		19		18
Senior Year					
Humanities	4	*Humanities*	4	*Humanities*	4
Machine Design I	4	Machine Design II	3	*Economics, Intro.*	3
Heat Transfer	3	Metals & Alloys II	4	Metals & Alloys III	4
Gas Dynamics	3	Inst. & Controls	3	Technical Elective	4
Mech. Lab.	3	Tech. Elective	4		
	17		18		15

AIM FOR AMES IN 1956 - - - AIM FOR AMES IN 1956 - - - AIM FOR AMES IN 1956 - - - AIM

AIM FOR AMES IN 1956 - - - AIM FOR AMES IN 1956 - - - AIM FOR AMES IN 1956 - - - AIM





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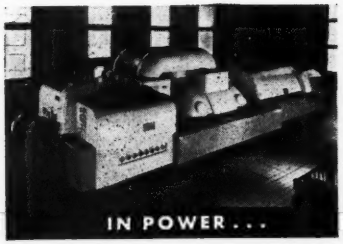

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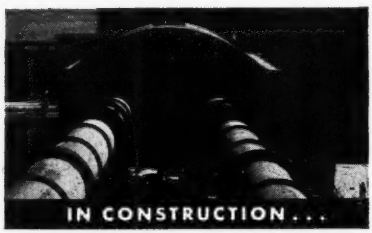

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The inquiring

Mind

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Harlow H. Curtice, GM President, described it as follows—

"It is really an attitude of mind. It might be defined as bringing the research point of view to bear on all phases of the business.

"This involves, first, assembling all the facts; second, analysis of where the facts appear to point; and third, courage to follow the trail indicated even if it leads into unfamiliar and unexplored territory.

"This point of view is never satisfied with things as they are. It assumes that everything and anything—whether it be product, process, method, procedure, or social or human relations—can be improved.

"I have tried to think of a single term to describe this attitude, and I think perhaps the closest is *the inquiring mind.*

"I truly believe that in General Motors we have developed to a unique degree this attitude of the inquiring mind."

We thought that you—as an engineering educator—would be interested in Mr. Curtice's statement. And that you might wish to pass it along to students who have an inquiring mind of their own.

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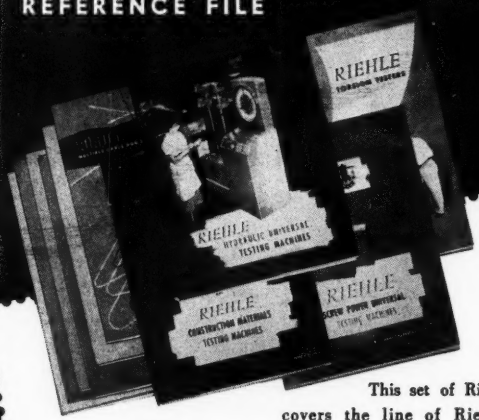

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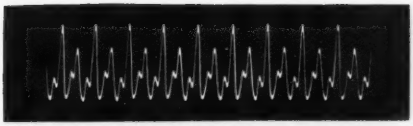
An intrstng exprmnt in spch

Some day your voice may travel by a sort of electronic "shorthand" when you telephone. Bell Laboratories scientists are experimenting with a technique in which a sample is snipped off a speech sound—just enough to identify it—and sent by wire to a receiver which rebuilds the original sound. Thus voices can be sent by means of fewer signals. More voices may economically share the wires.

This is but one of many transmission techniques that Laboratories scientists are exploring in their search for ways to make Bell System wire and radio channels serve you more efficiently. It is another example of the Bell Telephone Laboratories research that keeps your telephone the most advanced on earth. *The oscilloscope traces at right show how the shorthand technique works.*

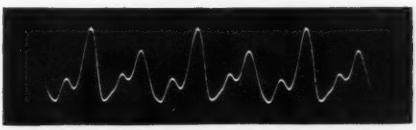
BELL TELEPHONE LABORATORIES

World center of communications research. Largest industrial laboratory in the United States.

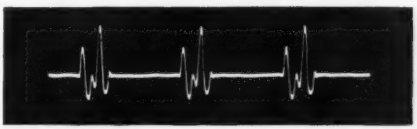


Vibrations of the sound "or" in the word "four." Pattern represents nine of the "pitch periods" which originate in puffs of air from the larynx when a word is spoken.

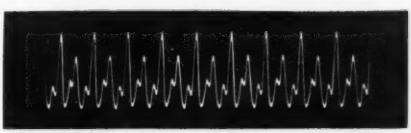
An electronic sampling of the "or" sound. One "pitch period" in three has been selected for transmission. This permits great naturalness when voice is rebuilt. Intelligible speech could be sent through a 1 in 6 sampling.



The selected samples are "stretched" for transmission. They travel in a narrower frequency band than complete sound.



Using the stretched sample as a model, the receiver restores original frequency. In all speech, sounds are intoned much longer than is needed for recognition — even by the human ear. Electronic machines perform recognition far faster than the ear.



The receiver fills in gaps between samples, recreating total original sound. Under new system, three or four voices could travel at once over a pair of wires which now carries only one — and come out clearly at the end!

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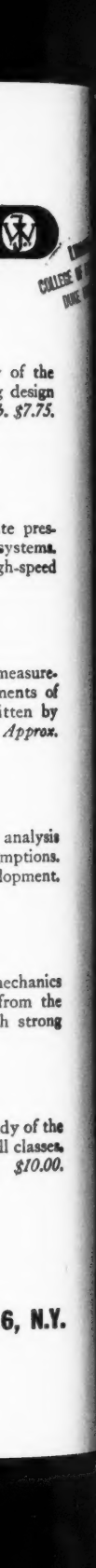
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